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ABSTRACT

This monograph examines methods of promoting safe practices in the conduct of selected team sports with the aim of reducing and eliminating the occurrence of injuries. The team sports discussed are baseball and softball, basketball, field hockey, tackle football, touch and flag football, ice hockey, lacrosse, and soccer. (MJB)

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Sports Safety Series

Monograph #3

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Safety in Team Sports

Monograph #3 Sports Safety Series

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Foreword

This is the third of the six monographs which will comprise the *Sports Safety Series*. This series is designed to provide a comprehensive guide for individuals concerned with injury prevention and hazard control in all areas of sports and recreation.

This new series constitutes a revision of the textbook, *Sports Safety*, which was initially published in 1970 by the Safety Education Division of the American Association for Health, Physical Education and Recreation (AAHPER). The American School and Community Safety Association (ASCSA) has replaced the Safety Education Division as an association within the recently structured American Alliance for Health, Physical Education and Recreation, and therefore, has assumed the responsibility of revising the original sports safety text.

Instead of including all contributions in a single publication, the material has been divided into six smaller monographs that may be purchased individually. To accommodate those persons who desire to buy all six monographs, a limited number of all of the booklets will be bound into a single volume which will be available at considerably less cost than if each publication were purchased separately.

The first monograph was titled, *Administration and Supervision for Safety in Sports*, the second, *Accident Surveillance Systems for Sports*, and this, the third, is titled, *Safety in Team Sports*. The fourth monograph will be concerned with individual and dual sports, the fifth with safety in aquatics and the last monograph in the series will deal with safety in outdoor recreational sports.

The ASCSA and the Co-editors are deeply indebted to the many individual authors who are identified in the list of contributors in each monograph. In many instances the authors were kind enough to revise their original contributions but in other cases alternate authors consented to re-write designated areas.

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Chapter 1

BASEBALL AND SOFTBALL

Warren J. Huffman
University of Tennessee

Very few deaths to either players or spectators have resulted directly from baseball or softball. However, serious and minor injuries occur each year to thousands of players, especially among younger and beginning players.(18) Injuries each year curtail either temporarily or permanently the sports careers of baseball players from the little leagues to the major leagues.

Ryan stated that "the hazards in the game of baseball and softball can be divided into five groups: running, body contact, risk from both the bat and ball, the barriers which enclose the spectators, and hard throwing and swinging motions." (21:254)

Polk surveyed professional and college baseball teams throughout the country concerning the frequency and causes of baseball injuries. He noted that five types of injuries account for 82.5% of all injuries. They are in order and percentage of occurrence, sprains 27.3%; strains 18.7%; contusions 16.9%; pulled muscles 11.3%; and fractures 8.3%. (19:19-20)

Polk found that:

Sliding and running between bases were the primary causes of sprains. The strain was predominately caused by throwing, followed by running between bases. A contusion injury was caused by the batter being hit by a pitched ball, followed closely by collisions between players. The pulled muscle injury was caused primarily by players running between bases, followed by throwing the baseball. Finally, the fracture was caused equally by sliding, and the batter being hit by a pitched ball. (19:53)

Hein listed five general underlying principles for accident prevention in all forms of sports. These principles are: (1) developing skills; (2) conditioning of participants; (3) supervising play; (4) providing equipment and facilities; and (5) assuring health care. (8) Many of the injuries in softball and baseball can be reduced to a minimum by following these principles developed by Hein. These five general principles serve as the outline for the remainder of this discussion.

Developing Skills

According to McConnell:

It is possible to perfect baseball skills and at the same time to avoid injury. In fact the possession of skills helps to prevent accidents. Very seldom do we hear of a player who executes a play properly being injured. The man who knows how to throw, and uses this knowledge in throwing, doesn't pull muscle in his arm, and the fellow who knows how to slide and uses this knowledge doesn't sprain an ankle or strain an elbow. It is important that every player concentrate on the basic fundamentals. (17:10)

Catcher. The catcher is one of the most likely players to be injured. Hazards include the constant pounding of the hand by the pitched ball, the jolt of foul tips, home plate collisions, smashed fingers, broken knuckles, and bruised throwing arms.

Foul tips are a major cause of injuries to the catcher. The bare hand is most vulnerable. Because of radical changes in the design of the catcher's mitt, catching techniques are changing. When using the old-style mitt it was necessary for the catcher to use both hands while catching the ball. According to Vivian:

The day of the two-handed catcher is rapidly becoming a thing of the past. The round piece of leather and padding with the center pushed in, which was once a catcher's mitt, is quickly disappearing from behind the plate. With single and double hinges, snap action, and lightweight padding, the new gloves are resembling a first baseman's glove. The new style gloves allow one-handed catching by improving and enlarging the pocket area, and because of their light weight, provide quicker handling.

Low pitches and throws in the dirt can be fielded instead of blocked. High or wide pitches are more easily caught instead of knocked down. Also, the ball can be gripped quickly for a throw due to the large pocket area. . . . The handling ease of the new gloves now allows the catcher to hide his arm and hand protecting them from foul tips or even wild pitches in the dirt.

A two-handed catcher cups his bare hand over the ball immediately after receiving the pitch. The one-handed catcher does not cup the ball in the glove. He relies on the glove to snap over the ball and hold it while his bare hand is being protected.

A two-handed catcher usually holds his throwing hand and arm in either of two positions: 1) His arm is extended and his hand is holding the bottom of the glove. 2) He cups the hand with the thumb and index finger touching and held slightly to the side of the glove with the arm flexed. These two positions allow the catcher to grip the ball quickly in the glove to control pitches and to be ready to make a throw. Both positions expose the fingers and the throwing arm to foul tips or wild pitches that are bouncing in the dirt. . . .

Before stating the proper technique for one-handed catching, it is necessary to emphasize the need of using a glove which is light and hinged to give maximum efficiency in handling. Assuming the proper position to receive the pitch, which is basically the same in both styles, the catcher's throwing arm is placed behind his back with the knuckles resting on his buttocks. This position turns his arm inward and reduces the exposed arm surface to a minimum.

With a runner in position possibly to steal, many coaches want both hands up ready to make a throw. The throwing hand can still be protected by holding it on the side of the thigh, or cupped behind the glove out of the way of foul tips and still get off a throw just as fast. The catcher's throwing arm can be placed in position quickly while he is gripping the ball; therefore, his release will be quick.

One-handed catching is the future technique in baseball. All young catchers should be taught the two-handed method and only when they are proficient in it, should the one-handed method be introduced. A combination of both catching methods is necessary in order to handle all of the situations which are presented in a game. (28:48-50+)

Elston Howard has listed some safety techniques which are useful for the catcher:

1. Place the forefinger of the glove hand outside the mitt or use sponge rubber inside to ease the impact of the ball. (Note: The increased use of golf gloves for catchers inside the mitt for protection from the constant pounding of the ball).
2. Hold the rim of the glove with the bare hand or keep the bare hand folded and not clenched until the ball is in the mitt.
3. Keep in front of the ball. Shift body with a quick shuffle or hop rather than move the glove; never use a crossover step.
4. Catch close enough to batter without letting glove interfere with bat and also avoid being hit in back of head.
5. Get mask off in a hurry to spot the ball on pop flies. The catcher should not throw the mask until ball is spotted, then he should throw it away from the ball.

6. Teammates should give instructions concerning the proximity of barriers, obstructions, dugouts, and other hazards while catcher is chasing a fly ball. (11:4-9)

A play that often causes injury to the catcher is the play at the home plate. This may be brought about because of the false sense of security of the catcher in the equipment worn, particularly in baseball. Frequently the catcher, depending upon his added protective equipment, will block the plate trying to keep the runner from scoring. The oncoming runner knocks the catcher down with possible injury to either the catcher or runner or both. The technique of staying in front of home plate and sweeping or diving for the tag is becoming more popular than the long used technique of standing behind the plate. Whenever feasible, the catcher should be on balance and plant the left foot in front of the plate with the shinguards facing third base. Most catchers like to leave the outside (foul) part of the plate to the runner so that the runner will attempt to slide rather than resorting to knocking the catcher down. If possible, "when making a tag on the runner, grip the ball in the bare hand and place the hand and ball in the glove. Tag the runner with the back of the glove." (28:94) The newer type of catcher's glove which closes over the ball allows sweep tags and lunges to get the runner after a wide throw.

Pitcher. Injuries happen to pitchers while throwing the ball and fielding the position. Arm and shoulder injuries are the most common in baseball, because the overhand pitching motion is an unnatural motor movement for the body. These problems can result from: (1) throwing pitches or using styles of delivery which put a great amount of strain on the arm or shoulder; (2) a lack of conditioning; or (3) throwing too hard for a long period of time or throwing too many pitches. The last two points are discussed later under other sections of this chapter.

Pitching styles vary considerably, but the young pitcher should try to perfect a smooth delivery that will not put undue strain on his arm and shoulder. There are three check points which have proven helpful in teaching beginners to throw: (1) keep the arm as straight as possible, with the back of the hand pointed downward on the fully extended backswing; (2) do not permit the wrist to rotate until the arm is fully extended and as far to the rear as possible; and (3) finish the throw with the back of the hand facing forward on the follow through. (15:5)

Throwing the curve ball is a problem for pitchers and especially for the young pitcher because of the relatively late completion of bone development. Before bone growth has been completed there is a distinct weak point at the epiphyseal plate of long bones known as the epiphyseal line. The epiphyseal line does not disappear until the bones complete ossification. Before this time the ligaments at the joints are stronger than the area around the epiphyseal line and certain movements might create sufficient stress and cause the epiphyseal plate to be partially separated and thus the bone may grow improperly due to pressures around the weak point. The motions particular to the curve ball can possibly damage this area resulting in temporary or permanent damage to the bone. Permanent damage might be (1) no growth; (2) angulation at the growth plate; or (3) deformation at the end of the bone. Temporary damage might cause slowed or accelerated growth. After the epiphyseal line disappears the curve ball might result in damage to ligaments as opposed to bone damage in the younger pitcher. (25:1-8) Throwing curve balls by young growing players should be discouraged, if not forbidden. The young pitcher should be encouraged to develop control and proper form instead.

When working with the pitcher in fast pitch softball the coach should be careful that good form is practiced and that the pitcher is protected. If she/he continually hits her/his side during the downward motion of the pitch, very painful bruises can result and cause a tremendous amount of discomfort. A pad can be worn on that side for protection. Cut-off sliding pads seem to be effective.

Regardless of the level of the sport, whether baseball or fast pitch softball, the pitcher is in the most vulnerable position to being struck by line drives. It is for this reason that in teaching a young person how to pitch, follow through and balance should be emphasized. The pitcher should finish the pitching motion and immediately be in a position to receive a line drive.

Follow through also helps to prevent sore arms. A few other ways for the pitcher to prevent from being hit or hurt is to keep the hair over his/her eyes short and wear a cap that will stay on and not fall over his/her face upon releasing the ball. Another safety precaution is to use a glove of sufficient size. It will help in knocking down balls hit through the middle of the diamond and perhaps save a ball game or prevent an injury. Particular attention should be paid to the batting practice pitcher since many balls are hit back through the pitcher's box, particularly by players of high school age or younger.

First Baseman. When the first baseman prepares to receive throws from other infielders, he should place one foot on the inside corner of the bag, giving most of the bag to the runner. This will help avoid getting stepped on by the runner and keep him clear of the baseline, thereby reducing the possibility of a collision. If he/she is pulled off the bag and has to tag the runner coming into the bag, the tagging arm should be relaxed to avoid injury.

Infielders. The majority of injuries to infielders occur in the tagging or forcing out of a base runner. Infielders suffer spike wounds of varying severity on plays where an opposing team's runner slides feet first with spikes high into the base the infielder is attempting to cover. Most players can continue to play after treatment of the average superficial spike wound but sometimes a player will sustain a deep gash that will force the player from the game and require several stitches. The fielder usually can prevent spikings by straddling or standing slightly behind the bag when he/she is attempting to tag out a runner who is not forced on the play. As the ball is caught he/she either sweeps (depending upon how close the runner is) or puts the glove containing the ball directly down next to the base in the line from which the runner is coming. The fielder making the tag should be sure to protect himself/herself from getting cleated as well as runover if the runner decides not to slide. When the fielder has to tag a person running by, he/she should tag quickly and low, then get out of the way.

The double play is a situation which can be very dangerous for the fielder taking the first throw. In most double play situations the leading runner being put out will try to prevent the batter from also getting thrown out. The player making the first out should be aware of this and know how to touch the base and get out of the way of the runner. Coaches should emphasize different situations and point out that sometimes throws will be off target and alternate methods must be used to get the lead runner. A sweep tag with the foot; a touch, step back and throw; or the touch, step across and throw are several ways the play can be done. (3:53;23:106) The important thing for the pivot man to do is to make the pivot a different way each time so that the runner will not know from which side he/she will throw. Many infielders will jump high to avoid the oncoming runner, however, this is a technique which should be used only by the more highly skilled players.

In fielding ground balls the infielder should stay close to the ground, keep his/her eyes on the ball until he/she fields it, and remember to play the ball and not let the ball play him/her. The infielder must charge toward the ball if possible and learn how the ball hops. He/she must watch the ball into the glove and remember glove position. If the ball is above the waist, the heel of the hand is lower than the fingers. If the ball is below the waist, the fingers are lower than the heel of the hand. When picking up the ball the glove should start on top of the ground and come up if necessary rather than starting up and going down. The bare hand should be beside the glove and be ready to get the ball once it is in the glove. The bare hand can help also to knock down bad hops. The cardinal rule in fielding a ground ball is to keep the eyes on the ball. "Turning the head only gives the ball a better chance to hit the fielder in the face if the ball takes a bad hop." (17:55)

Ankle sprains often bother the infielder. Sometimes on plays where he/she must go from the sure footing of the infield dirt to the unsureness of the outfield grass, the fielder will turn an ankle in his/her haste to get the ball or to get set for the throw. There is not much the player can do to prevent this occurrence except to check out the playing surface in order to learn which

spots are wet or slippery.

Outfielders. The major danger of playing the outfield is that of collisions with the fence, with other outfielders, or with infielders. There are several factors that determine where an outfielder should play. Generally the distance he/she plays from the fence will depend upon his/her ability to go back to the fence for balls hit over his/her head. "To avoid crashing into the fence, the fielder first hurries to get to the fence. Then he quickly turns around to relocate the fly ball and catch it." (18:6)

The outfield must work together as a unit. The centerfielder is the key person in the unit and should handle any ball he/she can get unless another outfielder is in a better position. The player who is going to take the ball should call loud and clear for all fly balls. The other fielders should immediately reply for him/her to take it. Extreme care should be taken on line drives hit between the fielders since it is difficult to tell who should attempt the catch. Experience in playing together should minimize the danger of such collisions. Fly balls that are hit between the infielders and outfielders should be taken by the outfielders whenever possible. Both Livviller and Weiskopf discourage shoestring catches except when it means the winning run may score if the catch is not made. After such a catch the fielder should relax and roll with the fall. (4:92;30:204)

On sunny days all fielders should wear sunglasses. The glove also can be used to shield the eyes from the sun. Care must be exercised when using the glove as a shield to prevent blocking the ball from view.

Sore arms are a common occurrence among outfielders, caused either by too much throwing or by making an unnatural off-balance throw to get a runner. Taking care of the arm and making sure the body is set to throw before throwing are two ways an outfielder can reduce the chances of getting a sore arm.

Batter. While there is no particular batting style recommended "each batter should be in his proper stance and ready to hit at the time the pitcher's delivery is to be made. Great batters . . . are never lax at this point. Prior to the delivery, however, they are completely relaxed from head to toe." (4:107)

It is important that the hitter take a comfortable on-balance stance and keep his/her eye on the ball. This should enable him/her to avoid being hit by a pitch thrown at him/her. Not only because helmets are required, but also for purposes of safety they should be worn at all times while batting, whether in practice or in a game.

Another injury common to the batter results from fouling a ball off the shin or foot. It can be extremely painful and cause the player to miss several games. Most hitters who suffer this injury are "chop" hitters or those who swing down on the ball. To prevent this injury the player can wear a modified shin guard on the lower part of the leg. Proper batting instruction to the beginning player may be a way of preventing this injury.

Pulled muscles can bother the hitter who does not warm up before attempting to take good strong swings in batting practice or during the game. It should be stressed that the hitter loosen up the back, shoulder and arm muscles early in the practice or game to avoid being hampered by pulled or strained muscles.

Turning in toward home plate on a bad pitch is common among younger players. A player should be instructed to drop down on those pitches headed directly toward him/her above the waist. Pitches lower than the waist usually are more difficult to get away from but jumping up, jumping forward, or backward seem to be the best methods. If it is evident one will be hit, it is better to have the back to the pitch as opposed to the front of one's body. This applies only to fast pitch softball or baseball. (3:23)

Sometimes youngsters or even adults will use an incorrect bat size, one that is either too long or too heavy or both. Too much weight in a bat can result in a pulled muscle if the person has trouble getting the bat around on the swing. If the bat is too long there is a possibility of getting

hit in the stomach: because of "choking up" too high on the handle.

Overstriding is a fault with some batters. If the feet end up too far apart, the player will have poor hitting form, and will be more susceptible to getting hit by wild pitches. Coaches should emphasize consistent stride length and make sure that these lengths are appropriate for each player.

Bunting the ball is a specialized form of batting and has different purposes, such as sacrificing a runner to the next base or bunting for a base hit. For the inexperienced player it is best to square around and face the pitcher, slide the top hand to a position about in the middle of the bat with fingers close together while fingers and thumb form a V behind the bat. The ball should contact somewhere on the top half of the bat. Incorrect body position when squaring around can result in injury to the batter. The batter should be instructed to face the pitcher but keep the inside leg in the batter's box. If the bunter gets too far over the plate, he/she is likely to get hit. The body should not be in the strike zone, the outer (top) one-half of the bat is in the strike zone. The head remains outside the strike zone and behind the inner (lower) one-half of the bat. (10:160-62)

Some players are notorious "bat throwers." While this is sometimes accidental, the practice should be discouraged early in the player's career. One method might be to declare the batter out for throwing the bat regardless of the outcome of the play. Since this penalizes the player's team, pressure from teammates can be an effective deterrent.

Base Runner. Quick starting, speed in running the bases, and ability to slide properly are fundamental. The player must be properly conditioned in order not to pull muscles with quick starts. He must be taught to look where he is running and depend upon the coaches for instructions except when the ball is in his line of vision.

In running out batted balls to first base when a turn is not going to be made, the runner should run straight ahead touching the front edge of the base with the toe. Most authorities recommend sliding into first base only when attempting to avoid a tag by the first baseman who has been pulled off the bag by a wide throw.

Since the bases are laid out in the form of a square, it is recommended that they be run that way and not in big loops whenever a base is to be rounded. (9:236) Regardless of which foot touches the base, the runner should concentrate on touching the inside of the base and pivoting toward the next base. It is best to use the left foot for touching the base. However, if stride length results in the right foot getting to the base first, it is better to touch with the right foot as opposed to stutter stepping to touch with the left foot.

Players should be taught the proper techniques of sliding as early as little league age. Most authorities advocate feet first sliding except under special circumstances because the risk of injury to the head, arms, or hands is great in sliding head first. The most important thing to remember is that once the player decides to slide he/she should complete his/her slide. "More sprained ankles, broken legs, and other injuries are inflicted on base runners by this mental lapse than by any other playing action." (4:122) In teaching the beginner the skill of sliding, some general rules to stress are as follows: (1) bend the knee of the bottom leg upon which the weight rests and slide on the calf of that leg (bend the knees of both legs in learning); (2) tag the base with the top leg which should be held loose and relaxed; (3) start with short distances and be sure both legs are bent at the knee; (4) throw the head back as soon as the legs are bent. This will prevent the knees from hitting the ground first (3:39) In practicing the slide, the beginner should remove the shoes and practice on a dry lawn or sand pit. He/she should use practice pants and pads on the hips to prevent abrasions. Whether practicing or in the game, the person should hold dirt or grass in each hand. This will help prevent jamming the fingers when sliding. (5:87)

As the player becomes more experienced more advanced sliding techniques can be taught. The type of slide depends primarily upon the position of the fielder in receiving the ball. The head-first slide is probably the quickest. "All the runner needs to do is dive — as though he

were diving into a pool — with his arms extended and reach for the base. His body should be flat and he should land on his chest reaching out (to the base)." (7:34)

The hook slide or fadeaway slide usually is best for stealing bases, because it provides less target for the tag. As an example the right leg hook slide to second base is as follows:

The runner, already along the back edge of the baseline, simply leans or shifts his weight towards the outfield side of second, bends his right leg, tucks it under the left, approximately under the knee, and reaches out to tag the base with the toe of his left foot. In finishing his slide, his momentum will have carried the runner slightly beyond and away from the base and only his left toe should be touching base. The procedure would simply be reversed for the left leg hook or fadeaway slide. (7:36)

The lead man on attempted double plays should slide to avoid being hit by the throw. Harvath stated:

The only time I recommend a slide straight into a base is in taking out the fielder on an attempted double play. In this case, the slide should be started one or two steps later, thus creating a hard slide with no intent to injure the defensive player. (7:36)

The first and third base coaches as well as the on-deck batter are essential to the success and safety of the baserunner. The base runner is dependent upon them for signals regarding whether to slide, to stay up, to continue running, and the direction in which to slide. In addition, the on-deck batter has the responsibility of removing a bat or catcher's mask lying along the third base line. (13:187-88)

Conditioning the Participants

Baseball and softball are unique in that only three individuals are actively involved in every pitch — the pitcher, catcher, and batter. While it is true that all players should be alert on each pitch and a few may be involved, the majority of players will not participate in most plays. This is particularly true of outfielders, who may only be called upon once in a game to catch and/or throw the ball.

Eberhardt stated:

As a conditioner, the game of baseball does not provide the activity necessary to develop a player physically in order to meet the special emergencies which arise during a game. This is why the baseball player should supplement his actual game experience with special conditioning exercises. (31:10)

Bauman corroborated Eberhardt's statement:

We often find that the batting, fielding, and throwing work are not sufficient to gain proper conditioning. Where greater demands are made, a player needs additional strength, power, and endurance for peak performance. (31:11)

Too often the training and conditioning programs at every level of competition do not allow for such effort. Many ballplayers do not push themselves hard enough while in the training or conditioning phase and this is a direct cause of many injuries sustained during play.

Alston and Weiskopf listed the following objectives of a good conditioning program: (1) a stronger, more powerful body; (2) increased speed and quickness; (3) more agility, flexibility, and coordination; (4) increased resistance to injury; and (5) greater stamina and endurance for a stronger finish. (1:418) Alston and Weiskopf stated further that "the coach must sell the idea to his athletes that an individual will be a better ballplayer if he will stay in condition." (1:418)

Since speed, agility, and coordination are key ingredients for success in baseball or softball it is important that the body and particularly the arms and legs be kept in shape. During the off-season jogging and running, stretching exercises, twisting, bending, and sports such as handball are recommended. Before and during the season it is important that players continue running, particularly wind sprints, and stretching exercises. Each player should warm-up properly for running and throwing before trying quick starts or throwing hard.

While there is some conflicting research evidence about the effect of warm-up upon

performance, most coaches believe that warm-up is valuable. Jensen stated that "it must be recognized that indiscriminate warm-up may waste energy while producing limited results." (12:72)

Jensen listed these guidelines for conducting warm-ups:

1. Warm-up should be intense enough to increase body temperature and cause perspiration, but not so intense that it causes partial fatigue.
2. Warm-up should include some stretching and loosening exercises along with heavy work.
3. It should include movements that are common to the performance Maximum efforts should be avoided during the warm-up.
4. The warm-up should begin to taper off 10 to 15 minutes prior to the performance and end about 5 minutes before performance. This will allow recovery from any slight and temporary fatigue without losing the effects of the warm-up. (12:72)

During the game every player must use each opportunity to keep his/her muscles warm and supple for the moment when extra effort is required. The batter should run out every play, even the so-called "sure-out". Players should hustle to their positions every inning. It is customary for infielders to practice fielding and throwing each inning when they take the field and for the pitcher and catcher to take their warm-up tosses. It is equally important that the outfielders take a few practice throws, particularly on cool or cold days. Batters should take a few practice swings before stepping into the batter's box.

Because both the baseball and softball pitcher throws the ball in an unnatural way, (21:254) it is extremely important that the arm be well conditioned and properly warmed-up before pitching.

Weiss stated:

The conditioning of the pitcher's arm is a prime responsibility of the coach on every level of competition. Nothing can hurt a team's championship chances more than having its "ace" come up with a sore arm.

I believe that most arm problems are due to overwork: throwing too hard too soon, throwing too many pitches too soon, throwing too many pitches at one time, or throwing without adequate rest. (32:84)

Taylor stated:

A pitcher should take special care of his arm when he is not using it. He should always keep it warm and well protected from cool or cold air, especially after he has finished pitching. (27:10)

Coaches and managers must resist the temptation to overwork their star pitchers. However, each year this happens at every level of baseball. The player's welfare must be the prime consideration of the coach or manager. Another precaution to the coach or manager is that before embarking on a weight training program experts should be consulted. According to Bauman:

We discourage our pitchers from squeezing the rubber ball because then they develop muscles of the flexor group. When the forearm is extended to throw, something has to give. Now these muscles have been made too strong, and usually, they tear around the upper epicondyle where they have their origin. The pitcher finishes with a bad elbow, or sometimes even tears a piece of bone. Therefore, exercises should be done under supervision. (30:66-67)

Supervising Play

It is essential that the coaches and officials who have the responsibility for supervision of play be well versed in the game. In addition to the technical knowledge of the skills of the sport and the ability to transmit this knowledge to the players, the coach and official must have an understanding of what effect the activity will have upon the welfare of the participants.

Nothing is more conducive to accidents than equipment strewn on the ground, or spectators

crowding the playing area, or players "horsing around" on the bench. To minimize accidents, the coach and/or other persons in charge must have definite procedures to follow for every player and spectator during the practice and the game, and insist that they be followed. This is particularly true during practice because of the varied activities conducted simultaneously.

Principles developed by the late George T. Stafford in 1947, and quoted periodically since that time, are as applicable today as when they were written. This simple set of principles, if carefully followed, will offer a maximum of safety. These principles involve:

1. An understanding of the hazards involved in each activity;
2. the removal of unnecessary hazards;
3. compensating for those hazards which cannot be removed, and
4. creating no unnecessary hazards. (26:94).

Understanding the Hazards Involved in Each Activity. A thorough understanding of the hazards involved in any activity necessitates a comprehension of the nature of the activity, the equipment being used, leadership responsibilities, the place of skill in the activity, and the need for adequate classification and good physical condition of the participants.

Removing Unnecessary Hazards. Understanding the hazards connected with an activity does not imply that one must avoid the activity. Rather it should induce one to remove the hazards in order to make a good adventure possible. This may be done through two means: (1) by correcting or providing a mechanical feature, such as planning adequate play areas, leveling play areas, treating floors with slip-proof compound (applicable when used for indoor practice), providing well-lighted and well-ventilated locker rooms, and providing adequate first aid facilities; and (2) by emphasizing the human element, particularly good leadership that recognizes and removes equipment or mechanical hazards, that equalizes competition, and that trains and conditions pupils safely; and pupil responsibility for personal safety.

Compensating for Hazards which cannot be Removed. Even though we recognize and remove all known hazards that can be eliminated, some activities by their very nature cannot be completely freed of danger. . . . Skillful use of the body compensates for many hazards. Here again, good leadership becomes an important factor because the leader helps students to understand how they can participate in an activity with a maximum of safety. Teaching correct procedure, suitable progression, and adequate skills will compensate for many hazards. Constant vigilance is necessary to keep the over-ambitious from attempting activities beyond their skill and capacity. Not only the leader, but the pupil as well must be responsible for guarding against this possibility.

Creating No Unnecessary Hazards. Activities present hazards when competition is not equal. Since poor and inadequate equipment creates additional hazards, only the latest protective devices should be used. Early in the relationship of teacher and pupil, the pupil must understand that he must assume his share of responsibility for his own safety and that of others. A safety consciousness must be developed on the basis of skillful behavior versus reckless and foolhardy behavior, with safe conduct for greater adventure as the goal. (26:94-99)

While it is impossible to go into detail about the manner in which the coach should conduct practice, the writer has observed practices followed by some coaches that jeopardize the safety of the players. For example, in hitting practice fly balls to the outfielders, the fungo hitter hits the ball to a group of players allowing any or all of them to run after the ball at the same time. This is not only dangerous to the players but develops bad habits in the fielder. It should be clearly designated who is to catch the ball. A fielder should be taught that during the game he/she should call for the ball "I've Got It, I've Got It," and the other players should be taught to answer in a loud clear voice, "Take It, Take It." If the infield drill is going on, usually the

fungoes should be hit from the foul territory well beyond first and third bases. It is common practice to have some phase of infield and outfield practice going on at the same time as batting practice. When this is done, the fielders should be protected. Extreme care must be exercised that the fungo is not hit at the same time that the batter is hitting the ball.

In batting practice a baseball cage or proper backstop should be utilized if at all possible. Only one batter should be permitted in the cage at a time. No player should be allowed to stand where he can be hit by the batted ball or a released bat. A player should be stationed near second base to retrieve the baseballs. Fielders should be taught to throw the balls to this person. All balls should be thrown on the ground to this person if a hitter is ready to bat.

In pitching or throwing, practice time should be allowed for warm-up. All players should be far enough apart that wild pitches will not hit another player.

When working with young people there are some general considerations that a coach should be cognizant of. Practices should be planned in such a way that each player will feel that he/she is a part of it. No player should be allowed to stand around with nothing to do. It is important for the coach to organize for effectiveness and safety. There should be a specific place for all equipment, and the coach must insist that the equipment be kept in the designated area.

LaPlace and Little have excellent suggestions for the conduct of practice and game procedures. (14:10, 53-55; 16:46-47) Young gives excellent pointers for indoor batting practice. (33:36) The reader is urged to consult these sources as well as the several periodicals, such as *The Athletic Journal*, *Scholastic Coach*, *Coach and Athlete*, that devote considerable space to all phases of baseball and softball.

Providing Equipment and Facilities

The furnishing of proper equipment and facilities for baseball or softball is the ethical responsibility if not the legal duty of those responsible for the activities. The players must not only be furnished with proper equipment but also be taught how to use and care for it properly. Excellent general policies have been developed by the American Association (now the American Alliance) for Health, Physical Education, and Recreation. (2:18-21) Timm has written a most complete treatise on the construction and maintenance of baseball facilities. (4:267-321) Alston and Weiskopf have an excellent section in their book related to equipment and facilities. (1:510-515)

In many instances the playing field will be far from the ideal situation. This is usually due to a lack of funds or enough area in the immediate vicinity. In planning any athletic field it is important to make a survey of the community life and of its facilities and needs. The hazards of the athletic plant and the safety implications should be made known to the architect. Many architects must be carefully supervised or they will sacrifice safety for appearance or cost. (22:185)

Orientation of the field for either baseball or softball should be considered because of the sun. For most sports the field can be placed so that the late afternoon sun rays will intersect the flight of the ball at an angle of approximately 90 degrees. However, in baseball the flight of the ball does not parallel any axis. The field cannot be oriented to give all players equal protection so a choice must be made. Since the batter, pitcher, and catcher are in the most hazardous positions, they should receive first consideration. A line through these positions should be the axis for the field. The imaginary line from home plate to second base should be at right angles to the rays of the late afternoon. All light poles should be located outside the fenced in playing area and should be high enough to give sufficient light. Fence posts should be on the outside of the fence and the higher the better for safety purposes.

Grass growth versus use is a great problem especially where space is limited. After the best grass has been selected, the area must be controlled so that the turf won't be destroyed. It is necessary to start preparation of the area in the off-season in order to be ready in the spring. (6:198)

The infield, skinned areas, and pitching mounds should be made ready in the fall. All holes or low spots need to be filled long before the season starts. Permanent base plugs are recommended so that they won't give. All fences behind first and third bases should be high enough to deflect wild throws. If there is not a safe area for warming-up, one should try to be innovative in this area. Riverfront Stadium in Cincinnati is a good example of what can be done. A reserve player is stationed to protect the pitcher and catcher who are warming-up.

Once the field has been constructed, maintenance of it is of utmost importance. According to Alston and Weiskopf the qualities of a well kept diamond are:

1. A field that has firm but spongy turf on which the ball will take "good hops".
2. A pitcher's box built and shaped to hold up under the pounding a pitcher gives it.
3. A batter's and catcher's area with firm footing for hitters, without the presence of deep holes.
4. Well-constructed base paths to allow for the maximum speed of runners, without leaving large divots. (1:512)

Grass should be mowed on a regular basis if possible. If there is any infield grass, it should be cut closer to the ground than the outfield grass. However, most schools or recreation departments cannot afford grass infields or artificial turf.

After each game or practice the field should be dragged. A cocoa fiber mat is effective but again one may have to improvise in this department. Any type of apparatus which smooths out the dirt top soil of the field is satisfactory.

Before each game the infield area should be given a good watering. If possible the pitching mound and home plate areas should be raked, resulting in a smooth and well-cushioned playing surface.

The following tools and equipment are minimum requirements for proper care of the playing field:

1. Rakes
2. Shovels
3. Drags
4. Mowers
5. Wheelbarrow
6. Line markers
7. Watering equipment
8. Batter's box marker
9. Brooms

In buying equipment for the squad, one should be careful to buy good equipment. Costs must be kept in mind and a careful calculation of objectives is demanded. Regardless of budget size, the key to good management is the best use of available funds. A little extra expenditure for better products will pay off over the years. Good equipment if properly cared for will last longer and is more economical in the long run. Rather than outfit a team with inferior equipment, the coach should omit nonessentials and buy well made essential items.

Equipment should be the last item to suffer if financial difficulty is encountered. Wise buying can help greatly in avoiding financial distress.

The stockroom is of utmost importance. Good ventilation and temperature control are essential. A stock room that is too hot can harm the leather products, and one that is too damp promotes mold, which affects all other materials.

Clean showers, well ventilated dressing rooms and clean uniforms are necessities. If possible fresh inner hose, undershirts, and jock straps should be provided for each player daily. If this is not possible, the players should be charged with this responsibility. (29:49)

Special attention must be paid to the equipment for the catcher because of the vulnerability to injury of his/her position. The catcher needs to wear a protecting mask in case of a foul tip and a

hard hat to protect against the backswing of the batter and also from the ball ricocheting off the backstop and hitting him/her in the back of the head. The female softball catcher must wear a chest protector because the female chest area is vulnerable to injury. The male baseball catcher should wear a chest protector and shin guards as well as a protective cup. All protective equipment should fit tightly and securely.

All male baseball pitchers should be required to wear a protective cup in practice as well as in a game. In practice the pitcher should have a net in front of him to protect him from line drives. The growing trend of requiring a hard hat for players other than the batter should be encouraged.

As mentioned in the previous section, players when facing the sun should have sun glasses. They should be taught how to use them properly.

If at all possible, there should be some warning device for players when they are approaching an obstacle such as the wall. In many parks a warning track near the fences is installed. Hard surfaces should be padded to protect players when they run into them. It was only after the star centerfielder for the Boston Red Sox ran into the wall during the 1975 World Series that a padding was put on the hard wall in Fenway Park.

If the school or organization is fortunate enough to have a training room, it should be isolated if possible and used only for the treatment of injuries. The room should be well lighted and ventilated. Washable paints are important to the cleanliness of the room. The floor should be of a product that is easy to clean. Properly grounded extra electrical wall plugs and proper voltage should be included in the electrical wiring. A sink is necessary. Drains for whirlpool and floor scouring are needed also.

A wall cabinet that can be locked is recommended. A refrigerator for ice or an ice-making machine is a very economical piece of equipment. Waste cans for the disposal of used dressings, strappings, etc. should have covers.

Hooks on the wall are necessary for clothes while treatments are given. A desk, or table with chair, and a file cabinet for the keeping of records will be helpful. A bench or chairs are necessary for those who are waiting their turn.

A medicine kit is a very necessary piece of equipment, particularly for a road trip. It is absolutely essential that someone on the coaching staff be trained in first aid or that a trainer or physician is present.

Assuring Health Care

Because of the excessive stress placed on the body and the physical contact with other persons and objects, injuries are inevitably a part of athletics. According to Alston and Weiskopf:

Many baseball injuries could be prevented by more effective conditioning and by observing various precautionary measures. Injury prevention and good health habits should be constantly stressed by the trainer and coach. All injuries must be promptly recognized and reported, and proper treatment must follow.

Common minor injuries can be treated quite effectively by a trainer or a coach. In the case of serious injuries, of course, or when an ailment persists, the team physician should be consulted. (1:450)

A medical examination is essential for ascertaining whether the person is fit to participate in the game. According to Hein:

Adequate medical care is that part of immunization against athletic injuries most directly related to health. Included is a thorough preseason medical examination as a requisite to participation in rigorous sports. Equally important is careful review of the health history of the prospective player to be sure nothing contraindicates participation. The immediate findings of the current examination are related to the health history in evaluating the fitness of a participant. (8:86)

Hein further recommended that "procedures for obtaining prompt medical care or transporting an injured participant should be worked out in advance." (8:86)

Hein stated further:

Almost everyone, including some physicians, I am sure, is tempted at times to get into the coaching business. Similarly, some teachers, leaders, coaches and trainers are tempted to cross the easy line between recognition, first aid, and referral into the area of medical practice. The lure is great: there are all sorts of modalities from red hot ointment to bioelectronic machines "that will surely outdo the doctor," and "after all, it's only a sprain." Both groups should resist the temptation to transfer their competencies and remain in the realm of their own knowledge and responsibilities. (8:87)

No attempt will be made to cover the first aid and treatment for the various injuries associated with baseball or softball. Rather the reader is invited to read some excellent references that go into detail about baseball and softball injuries. In addition to those references already cited, it is suggested that the reader consult Spackman (24) and Rawlinson (20).

In closing this chapter, there are two points that should be emphasized. The danger to the pitcher's arm, particularly the young pitcher, was covered in an earlier section. One method that is commonly used to protect the pitcher is to limit the number of innings pitched. This is a step in the right direction, but it does not go far enough. A better method would be to limit the number of pitches. This procedure is followed even in the major leagues.

There is recent evidence that the knee of the young catcher may receive irreparable damage from the squatting that places undue strain on the knee. To prevent this damage it would be wise to limit the number of innings that the player is used as a catcher.

Conclusion

When looking at the area of safety as it relates to baseball and softball, there are many aspects that coaches, managers, players, spectators, and officials must consider in order to promote a well developed program. We must realize that some of the hazards will be present as long as the game exists, yet there are some injuries that can be prevented. Things such as broken bats flying, the field conditions during the season, getting hit by a pitch or a throw, bad hops, sliding, bruises, overthrows, and weather conditions are hazards that probably cannot be removed. Things such as unorganized practices, loose equipment lying around, teaching correct techniques and conditioning habits, the coach's knowledge of the players, safe weather conditions, safe equipment, and care of injuries are areas where efforts must be directed if the programs are to be safe. We have to accept that accidents will happen, yet try to prevent as many as possible through keeping hazards to a minimum.

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CHAPTER 2

Basketball

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Basketball is considered a non-contact game, or it was so intended by its originator, Dr. James A. Naismith when he introduced the game in 1891. As basketball developed, it lost its characteristics as a non-contact sport. Because players are bigger, faster, stronger, and in better condition, the action is much rougher. Today there is a great deal of body contact and very little protective equipment to help avoid injuries. Today's game involves intense nervous strain and requires great endurance; for these reasons a participant must be in good physical condition if he or she is to play effectively and safely. Although strenuous, basketball has a relatively low incidence of serious accidents in comparison with football and other vigorous sports. Every season, however, a number of injuries result from collisions between players, poor physical condition, unnecessary roughness, poor officiating, improper personal equipment, slippery floors (from perspiration, dirt, or debris), inadequate play areas, tripping over play equipment, and more recently the unsportsmanlike conduct of spectators.

Another area of significant serious concern is the incidence of infection from relatively minor injuries that have not received immediate post-game or post-practice attention.

While agility, quickness, coordination, and desire are important qualities of a good basketball player, he or she must also be adequately conditioned to carry on assignments without undue fatigue, a contributor to accidents. For this reason it may be wise to employ a strength development program in conjunction with preseason or prepractice drills. Many coaches have found that such programs result in improved jumping ability, endurance and stamina, and confidence. The exercise program should be concentrated on the legs, back, arms, and shoulders since these are the important body areas in basketball.

As basketball for women has gradually evolved into the modern game, it has increasingly become a sport characterized by almost continuous running. This means that before a female is ready to perform adequately in the modern-day game, she must have attained a high state of physical fitness. She must "get in shape." She must be conditioned. To the coach, it means a procedure aimed at bringing about an increase in physical and psychological readiness through the regulation of the athlete's exercise, rest, and nutrition.(10)

A well balanced diet of normal foods will provide all the protein an athlete needs for peak performance.

Competitive basketball makes extraordinary demands upon the body and since the food taken in is the only source of fuel for energy, building materials for the repair and growth of tissues, and regulators for the control of body functions, the adequacy of each participant's nutrition must be of particular concern to the coaches in their efforts to increase the level of physical fitness among the candidates for the team.(10)

This applies particularly to women players as they are more apt to be concerned about weight problems than men participants.

Before the season starts and prior to opening practice, each player must have a complete, thorough physical examination and written approval of the team physician(s) to participate as a team member.

Suggestions to help minimize injuries during participation in basketball are included in the following sections.

Personal Gear

1. Each player must have well fitting shoes specifically designed for basketball. The shoe should have a nonslip tread and material with shock absorbing properties under the heel, transverse and longitudinal arch of the foot. The shoe must also afford adequate ventilation. The properly fitted shoe is the most important personal item of the basketball player.
2. A thin pair of socks under the regular sweat socks will help prevent blisters.
3. To lessen the risk of crippling blisters, especially in early season workouts, every player should liberally powder the feet to reduce friction inside the shoe and between the two pairs of socks. Running barefoot in sand prior to reporting for practice will aid in toughening the skin on the bottom of the feet. It is also a good practice to use foot powder before and after practice.
4. Safety lenses should be used by players needing glasses, and they should be firmly secured. Contact lenses are desirable since they reduce the risk of serious eye injury from broken glasses. Players not using either of the above should wear a protective guard over the glasses. All jewelry should be removed when playing.
5. Trunks should be equipped with light hip pads.
6. Padded knee guards are a valuable piece of equipment since they help eliminate floor burns and bruised bones.
7. Players with weak knees should seek appropriate medical advice on strengthening procedures.
8. Warm-up clothing should be provided and worn for pre-game drills and practice.
9. Individual towels or ample clean towels for players prevent passing disease germs among squad players.
10. Advise players to do daily running prior to the beginning of organized practice. This will help improve endurance, condition legs, and reduce the possibility of strained muscles.
11. For lack of better evidence to the contrary, at this time it is recommended that all female participants wear well fitting brassieres.

The Physical Plant and Field Equipment

1. There should be a minimum of 12 to 16 feet of free space at the end lines and six feet along the sidelines at basketball courts.
2. Gymnasiums with endlines that are close to the wall with permanent bleachers, stairwells, and permanent apparatus equipment should be checked for dangerous corners and protruding equipment. Such places should be adequately covered with plastic or canvas check-mats.
3. With large numbers of players on varsity and reserve squads, intramural teams, and in physical education classes, the rollaway bleacher is preferable to the permanent bleacher arrangement at floor level. The cross courts thus made available provide larger playing areas which will reduce accidents.
4. All wall attachments should be recessed or padded.
5. Benches, including timer's and scorer's table, and other obstructions should be kept as far away as possible from the playing area.
6. Basket supports should be properly padded to avoid possible injury if a body should come

in contact with them. Supports attached directly to the wall behind the basket or supports suspended from overhead are preferred to free standing apparatus.

7. A rack of some type should be used to hold basketballs that are not being used to prevent balls from rolling onto the court when play is in progress. If a loose ball does roll onto the playing area, action should be stopped.
8. Players should not be permitted to leave any piece of playing equipment near the playing area, especially under the basket.
9. Shower, locker, and training rooms should be kept spotlessly clean. A walking surface that provides good traction even when wet should be used. Recessed handles, soap dispensers, and an adequate number of showers to prevent crowding will help reduce accidents in the locker and shower rooms.
10. Playing floors must provide a resilient, nonslip surface and they should be thoroughly mopped before every practice and at half-time of each game.
11. Cool drinking water from sanitary paper cups should be provided if there is no fountain immediately available to the floor.
12. Ice should be easily accessible for injuries.

Practice and Game Routine

1. Correct execution of fundamentals is a reliable safety measure.
2. A properly conducted warm-up drill before the game or practice session decreases the possibility of injuries. About 20 to 30 minutes should be adequate.
3. The early season workouts should be designed so players will develop their physical condition and thus be able to play the entire game at peak efficiency.
4. During hard practice sessions, especially in early season workouts, frequent rest periods should be provided. This maintains a high level of alertness and lessens the fatigue factor as an accident possibility.
5. Players, particularly those with weak ankles, should have their ankles either taped or wrapped before every practice and every game. If it is not possible to have a team trainer perform this function, a student manager can learn how to wrap and tape ankles by contacting a varsity trainer at a college or university.
6. All practice sessions should have constant supervision by the teacher or coach.
7. If excessive perspiration is a problem, salt intake may be increased at daily meals to maintain saline balance of the body.
8. Coaches and trainers of basketball teams should avail themselves of the best current knowledge on nutrition to determine what is best for each individual participant. Normally a well-balanced diet will provide the nutritional needs of participants.
9. Although present-day medical science states that regular vigorous exercise has a beneficial effect on menstruation, there is still widespread misunderstanding of the menstrual function and many coaches and athletes lack assurance as to the proper course of action concerning participation in conditioning activities and competition during menstruation.
In general, current medical opinion states that if an athlete is able to participate in training and competition during her menstrual period without dysmenorrhea or other menstrual-related disturbances, there is no reason to discontinue or restrict such activity during any phase of the cycle.(10)
10. Because bad weather prevails during a major portion of the basketball season, precautions should be taken to ward off any illness that could develop. Warm clothing, scarves, and head covering should be worn particularly after a hard game when players are fatigued.

General Administrative Precautions

1. A certified trainer should be present at all practice sessions and contests, and a doctor

- should be on call during practice sessions and present during contests.
2. A complete physical and dental checkup should be made before the season opens, preferably by the family physician, again at midpoint, and after the season is over.
 3. A complete weight chart should be used and players should weigh in and out for all practice sessions.
 4. After an illness or an accident, permission should be secured from the team doctor before allowing the participant to resume playing and practicing.
 5. A first aid kit should be available for the coach and trainer. A thorough knowledge of first aid is essential for minimum safety.
 6. Clean towels, socks, and supporters should be issued to lessen chances of infection and injury.
 7. All practice scrimmages should be well officiated. If not, play is likely to get rough, thus increasing the chances of injury.
 8. When bus transportation is used for travel, all members of the team should ride on the bus with no exceptions. The coach is responsible for the safety of the participants whenever travel is involved. Only qualified drivers should be used.
 9. Competent and registered officials should be engaged for all interschool competition. They should be conscientious about the safety of the players in handling the play situations. Student officials should be trained to handle practice, intramural, and recreational play.
 10. Provision should be made for some kind of accident insurance to cover all participants.
 11. In recent years serious injuries have occurred to spectators and participants because of unruly spectators. As a result of this behavior, crowd control has become a vital concern of coaches, athletic directors and school administrators. Fan behavior is a difficult and complex problem. No plan provides all the answers, but some crowd control procedures should be formulated and implemented when necessary. Fans will usually behave when appealed to and when convinced that school officials are genuinely interested in promoting better conduct and sportsmanship.

Acknowledgements

Contributions to this chapter were made by Steve Douglas, Women's Basketball Coach at the University of Illinois and Ellie Wolf, Athletic Trainer of the University of Illinois Basketball Team.

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Chapter 3

FIELD HOCKEY

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Introduction

Field hockey is a major sport with respect to the number of participants involved, and the number of years they play. There are school and non-school competitive clubs for boys, girls, men and women. Rules differ between men's and women's play, and new rules have been written for the secondary school girls. The code of rules reflects concern for safe play. Coaches and officials, well versed in the rules, who can convey the safety aspects of these rules to the players and thus help improve the safety of the game, will keep field hockey the relatively safe sport, that it is (7).

Player Conditioning For Safety

The level of competition, speed, type of field, and the length of game play will be major factors in determining the amount of training and health services needed for the safety of the team. In general, more highly skilled players, faster fields, and longer games will necessitate higher levels of conditioning. Coaches can estimate whether or not players are in condition to compete by observing stick handling techniques and running speed after 30 minutes of continuous skill practices in which locomotion is a primary component. Many times practices involve drills in which players stand and wait their turn. These types of drills do not provide the conditioning necessary for competition. Drills in which all players are constantly moving are recommended.

Those players unable to perform at 80% of initial performance level after 30 minutes of mobile practice are not in condition for competition. Based upon research findings with respect to maximum VO_2 and strength training, 80% has been chosen as an estimate for minimum level of conditioning (10).

An alternate method of determining fitness for field hockey competition is to have players scrimmage for 30 minutes. However, this method has shortcomings, since some players may not have to perform strenuously, if play is not in their part of the field.

Numerous books have been written concerning theories and principles of conditioning and training. The reader may refer to such sources, a few of which are included and annotated in the list of references (1, 3, 6, 8, 9).

In addition, a few specific factors should be kept in mind with respect to training and conditioning for field hockey competition.

1. Cardio-respiratory conditioning for both endurance (as much as 35 minutes) and short bursts of sprint type of activity are required. A heart rate of 160 bpm is considered minimal for exercises designed to improve C-R system.
2. General conditioning to develop cardio-respiratory efficiency can be used; however, the actual game, or simulation of game situations must supplement general conditioning programs.

3. Eccentric contraction exercises (i.e., exercises in which a given resistance overcomes muscle tension and causes the muscle to lengthen) are recommended for strengthening the quadriceps, hip extensors, gastrocnemius and soleus muscles. These muscles act as "braking" muscles for sudden stops and turns which are prevalent in field hockey play. Isokinetic exercises are also of value, because they build strength throughout the full range of motion. In this type of exercise, the velocity remains nearly constant throughout the exercise, therefore, acceleration is prevented.
4. Since conditioning programs should be progressive in nature, a certain amount of individualization is required to prevent excessive stress in those who are less fit for competition. However, each day's workout should include an overload until the desired fitness level is reached. Once attained, the required fitness level can be maintained by repeating this level of stress in practice sessions.
5. The best preparation for safe play is a conditioning and training program which includes combined leg and stick work activity. Since muscle groups function with respect to speed of movement, position in space, and amount of force required, specific strength development and flexibility for field hockey play can be achieved most readily through the actual movements, speeds, and positions used in the game. Simulated game situations can help develop these desired movements, speeds and positions.

Facilities

More and more, field hockey is being played on artificial surfaces and at night, under the lights. While artificial surfaces tend to be smooth and free from the ailments common to turf fields, they do present some problems. On hot days, for example, the artificial surface may be 20 to 40 degrees hotter than the surrounding area. Thus many schools and colleges have taken to "wetting" down the artificial surface before the games to prevent the athletes from suffering heatstroke. If the water used to wet down the field is in any way polluted, however, abrasions suffered by players who fall may become seriously infected. This possibility should be brought to the attention of the field maintenance personnel.

Artificial turf play is much faster than play on natural grass, and when movements are faster, the forces of balls, sticks, and players will be greater, and the potential for injury will increase. Thus, players who expect to play on artificial surfaces should be more highly conditioned to avoid fatigue and to reduce the subsequent increased risk of injury.

Turf fields should be free of holes. Sprinkler heads, if in the field, must have safe covers. Loose dirt and stones are a menace to the poorer player, who may unintentionally undercut the ball and loft a stone. Dirt and stones also affect the hockey ball, and may cause it to be lofted and cause injury.

A major advantage of artificial surfaces is that players need not wear cleated shoes. Many knee injuries are incurred by players trying to cut quickly only to find that they cannot move because their cleats are firmly imbedded in the ground. On turf fields, however, cleats are recommended, as they provide needed traction. Cleats must be rubber, as metal cleats are specifically forbidden in the rules (4).

Two common types of rubber cleats are pictured in Figure 1. Type A, with the "half moon" cleat on the heel, permits the player to pivot more easily. Type B has four cleats on the heel, which are slightly different from the cleats on the front part of the sole. The heel cleats have two triangular projections from each of the four cleats. The front part of the shoe has an arrangement of ten cleats, divided into four rows of two, three, three, and two cleats, respectively. This large number of cleats permits better traction for the forward part of the foot. To aid the player and coach in selecting the safest shoe, more research into shoe design is indicated, especially as new types of shoes are marketed.



Figure 1
Different Cleat Arrangements for Field Hockey Shoes



Figure 2
Field Hockey Equipment: A. Shin Guard with Straps, B. Shin Guards without Straps, C. Goalie Pads D. Goalie Kickers

If the game is to be played at night, adequate lighting must be assured. The ball should be new or newly painted, and the field lines should be easily visible. Practicing on a lighted field, when possible, will help players become accustomed to these conditions.

In the city, where "schoolyard" hockey (hockey played on blacktop or cement), is common, players should wear sweatpants to prevent abrasions if they fall, and a softer ball should be used. The use of the push pass and other strokes less dangerous than the drive should be encouraged.

The front of goal cages should be painted white, so that players can easily see the cages. The use of wire netting, instead of cloth netting is definitely a hazard. Players may be cut by the wire or fall into it when following a shot. However, wire netting can not be vandalized as easily as cloth netting.

The use of pipe instead of wood for the cage frame is very dangerous, and should be avoided. If pipe or other metal must be used, padding will lessen the chance of injury. If the cage is set into holes dug in the ground, provision must be made to cover these holes when the field is being used for other activities.

The goal line and centerline flagposts can be replaced with plastic cones. If cones are not available, plastic flags on plastic posts should be used.

Extra balls, sticks, warm-ups, and other equipment should be moved away from the playing field before play begins.

Permanent bleachers should be set well away from the edge of the field, which is often not the case, especially in secondary schools. If bleachers are not available, spectators must be kept away from the sidelines of the field, so they will not be a hazard to the players, be hurt themselves, or interfere with officials as they move along the sidelines. Spectators should not be permitted to sit behind or next to goal cages. If pets are present, they must be restrained from coming onto the field.

Equipment

Requirements regarding sticks are plainly set forth in the rules, and must be followed. It is a good practice to tape the heads of the sticks to prevent splintering. No player should be allowed at any time to use a cracked or splintered stick.

Perhaps the most common injury in hockey is the shin or leg bruise which results from being struck with the hockey ball or stick. Thus, the use of shin guards, especially for younger and less skilled players, is recommended. Shin guards are of two basic types; those held on with straps, and those which fit inside socks and are held in place by various adhesives. (Figure 2,A; Figure 2,B)

The buckle type are preferable for unskilled players, as they have flaps which cover the lateral and medial malleoli and can prevent or lessen painful and debilitating injuries to these areas. Players need to be reminded to wear the shin guards with the buckles on the *outside* of the legs, not the inside, to minimize chance of the buckles cutting the legs. If there is a bottom strap on the shin pad, it should be of light elastic and worn inside the shoe.

The sock type shin guards, which fit inside the socks, are recommended for more advanced players. They permit more mobility, and lessen chances of being injured by buckles. However, they do not cover the ankles, and leave much of the upper shin unprotected.

The absorption qualities of shin guards have not been tested, thus it is difficult to know which type of shin guard is more effective in protecting the body part from injury. It is known that the absorption qualities of shin guards deteriorate with age. Subjective evaluation of shin guards may be made by comparing new and old guards in thickness, stiffness and rebounding qualities.

Many leg bruises can be avoided by teaching correct fielding techniques. Players should always field the ball outside of the body, never with the leg directly behind the stick.

More and more players are wearing mouth guards to protect the teeth. This is especially true at the secondary level, where the player may be undergoing expensive orthodontic treatments. Goalies are especially vulnerable in this respect. Some goalies wear ice hockey face masks, which is permissible under present rules. «

Goal keepers should be provided with additional protective equipment, which includes goalie pads, see Figure 2.C, goalie boots or kickers, see Figure 2.D, and a glove to fit the left hand. Pads, kickers, and gloves must be kept in good condition, and ripped or faulty equipment should be repaired.

If players wear glasses, they should be of the shatterproof type, or glasses guards should be worn. All glasses should have an elastic strap or other device to secure them to the player's head.

All players should wear uniforms which conform to the safety standards in the rules code. No kilt pins, metal brooches or other potentially dangerous items may be worn (4). Players should have warmup clothing for cold weather, and wear it during warmup drills and during halftime. It is also advisable for players to warmup prior to the game, be it with stick work, jogging, or practicing play (2).

If hockey practice must take place indoors due to inclement weather, certain other safety precautions need to be taken. Stick heads should be covered with socks. Balls can also be covered with a sock, or pudding or yarn balls can be used. Drives and other potentially dangerous shots should be barred. It is also advisable to play without goalies.

Officials and Coaches

Competent and conscientious officials can do much to protect players and lessen injury potential. Officials should inspect the field, and confer with the home team coach concerning possible hazards. For example, slippery areas in alleys, or depressions in front of the goal cage represent possible causes of accidents and subsequent injury. In all cases, an official should suspend or discontinue play if the field becomes too dangerous, either through ill care, inclement weather, or darkness.

Officials should warn players and penalize teams when necessary for dangerous hitting and kicking, or for undercutting the ball. Hitting opponent's sticks, hitting the ball without regard for another player's position, high sticking, and handling of opponents are prohibited in the rules and the official should enforce these rules to insure safe play. «

Coaches should have an understanding of anatomy, physiology, and the growth and development of children. Often, this is not the case, and coaches are chosen on their record as former players. Where this has occurred, administrators should encourage coaches to take classes or workshops in areas such as those suggested above.

Coaches should teach players safety skills as a part of daily practice. Avoiding bunching, being aware of other players, and good individual stick skills will make the game better and safer. A good coach will recognize both physical and psychological symptoms of fatigue in players, and teach the players to recognize and react to these symptoms themselves. Players should be taught that the ultimate responsibility for their own safety lies with them.

Health Service

Medical examinations should be required for all players participating in competitive field hockey (5). If the school staff does not include a medical doctor, one should be contracted to examine the participants. In the case of association or club players, personal physicians may have to be contracted, if no doctor is available. Another option for association players is to arrange with a clinic to examine all players on a selected day.

High school and college players should carry team or school insurance. When insurance is

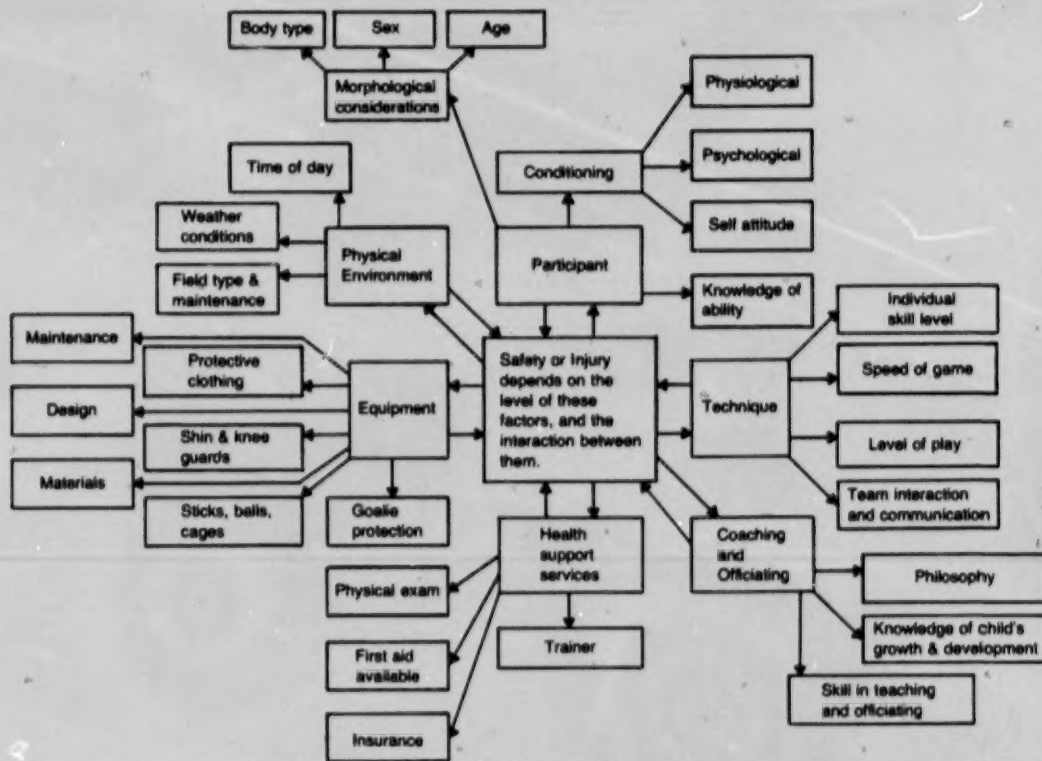


FIGURE 3. Factors Relating to Field Hockey Safety.

(Simpson, Kathy. *Factors Contributing/Relating to Injury/Safety*.

Unpublished manuscript. Washington State University, Pullman, WA. 1975.)

not available, forms should be sent to parents requesting them to be sure that their personal policies will cover any accidental injuries their children might incur.

During competitive events, the services of a trainer, doctor, or a person skilled in treatment of athletic injuries should be available on the field. Any supplies necessary for first aid should also be at hand. A telephone, with suitable emergency numbers attached, should be available to the coach or other authorized person at all times. Student's home phone numbers should be listed with the coach, and coaches should also list parent's work or daytime telephone numbers.

Field hockey is primarily a safe sport, and it can be made safer with the implementation of the preceding recommendations. All players should remember, however, that there is always a risk of injury whenever competing in sports. Although the ultimate responsibility for safety lies with the player, the coach should help each athlete realistically assess injury risk and thus be aware of potential injury situations. The model depicted in Figure 3 presents the factors which need to be evaluated in assessing potential injury and/or safety.

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Chapter 4

TACKLE FOOTBALL

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In the United States more than 16,000 public and private secondary schools sponsor organized football teams each fall, with a total of some 1.2 million young men participating. Another 100,000 young men participate at the college or university level. In addition, it has been estimated that some 200,000 boys are suited-up for competition by various community and social agencies such as metropolitan police, Boys Clubs, Lions Clubs, Kiwanis Clubs, church groups and many others. If the many thousand boys who play in football games of the sandlot or semi-organized variety were included, the total number playing would probably reach two million.

With this growing interest in football and its inclusion in the programs of more and more schools, it becomes increasingly apparent that additional consideration must be given to the safety of the participants. Many physicians feel that as many as half of these participants are victims of at least slight injuries each season. Any health problem which affects over a million young men annually is a significant health problem. Naturally, the problem is recognized by those closest to the game — the coaches, school administrators, team physicians and trainers, physical educators, and of course, the parents.

Among the primary responsibilities that school administrators, physical educators, coaches and others involved in school football programs must face is that of providing adequate protection against and care for injuries that occur. In order to meet their growing responsibility to protect the athlete, educators must take a greater leadership position in evaluating the risk of injury in football participation, developing preventive measures where applicable and enforcing greater adherence to accepted safe practices with regard to participation.

Football injuries have been accepted generally as an uncomfortable by-product of participation in the game. In a sport requiring vigorous physical contact within a restricted area for 48 to 60 minutes at a time, injuries are certain to result. However, every effort should be made to assure that the potential for injury is kept to the absolute minimum. The following suggestions, recommendations and comments are offered to help coaches, athletes, school administrators and parents prevent and reduce injuries associated with tackle football.

Medical Evaluation

Mandatory medical evaluation and medical history must be taken at the beginning of each season before an athlete is allowed to participate in any football activity. The complete medical history and medical examination should be on file with the proper school authorities where it

will be readily available if needed. It should also be required that a physician give written approval to permit a player to return to practice and competition after injury, especially if the athlete has incurred a head injury.

Whenever possible, a physician should be on the field of play during game and practice sessions. When this is not possible, arrangements must be made in advance to obtain a physician's immediate service should an emergency arise. Each institution should have a trainer who is a regular member of the staff and is qualified in treating and preventing injuries.

Every school and institution fielding a football team must subscribe to an athletic injury insurance program. There are several plans available and the type secured will depend upon the policies of the communities and states involved. An excellent source for information on athletic injury insurance is the American Medical Association's Council on Medical Services.

Physical Conditioning

Optimum physical performance can only be achieved by the athlete who is in top physical condition. Conversely, the athlete in poor physical condition will give a substandard physical performance. But more important, the poorly conditioned athlete is more susceptible to disabling injuries.

A program to aid the athlete in developing a state of physical fitness should be concerned with endurance, speed, flexibility and strength. Endurance refers to cardiovascular and respiration fitness which increases the ability of the body to take in oxygen and utilize it efficiently. Speed is an asset in all sports and can be improved by following a program which includes sprint running and agility or reaction drills related to the sport. Flexibility involves stretching muscles and ligaments in order to give the athlete a more complete range of motion and to prevent possible muscle and ligament injuries during early practices. Strength development programs are gaining importance in all sports, but especially for football. It is important to follow programs that are planned by experts in the field and are properly supervised.

A physical conditioning program designed to prepare an athlete for football participation would be remiss if it did not include special exercises to strengthen the muscles of the neck. The lightest form of strength developing exercises and often the first to be employed in a scheme of progressive resistance is lifting the head against gravity for 20 to 50 repetitions. One example of an exercise of this type is lying supine with the head over the end of a table and raising the head and placing the chin on the chest. These exercises can become resistive exercises by adding resistance in the form of weights or manual resistance. Additional exercises might include the back bridge, front bridge and isometric exercises with a second person providing the resistance manually. Each isometric exercise should be done with the head in the extended position, the neutral position and the forward flexed position.

It is strongly recommended that the first week of football practice include a graded type of conditioning program with particular emphasis on learning the system to be employed, the signals, the plays and timing. The physical conditioning program should include activities which will strengthen the body and reduce susceptibility to fatigue. There are many types of physical conditioning programs but running, grass drills and wind sprints should be included in all of these programs. Considerable effort during the initial conditioning period should be devoted to "dummy-type scrimmage" involving the football skills to be learned. This type of practice not only conditions the body but also develops psychomotor efficiency in the performance of football skills.

Preseason Practice

The majority of state high school athletic associations, as well as the National Collegiate Athletic Association, require a preseason physical conditioning period of from three to seven days for all football athletes before any physical contact between players is permitted. Research

has shown that the mandatory physical conditioning period reduces the number and severity of football injuries during the early fall practice period.

When football activity is carried on in hot weather, the following precautions should be taken: (1) schedule practice sessions during early morning or evening hours in August and early September; (2) acclimatize athletes to hot weather activity by following carefully graduated practice sessions; (3) provide rest periods of 15 to 30 minutes during workouts of one hour; (4) furnish extra water and salt in recommended amounts (a recognized replacement for fluid loss is a sterile 0.1% saline solution—that is, two teaspoonsful of ordinary table salt for each gallon of water; it is generally suggested that it be ingested at the rate of at least one quart per hour during condition of extreme perspiration); (5) watch athletes carefully for signs of trouble (fatigue, lethargy, inattention, stupor, awkwardness, etc.), particularly the determined athlete who may not report discomfort; (6) remember that temperature and humidity, not the sun, are the important factors and that heat exhaustion can occur in the shade.

Practice activity is responsible for a large percentage of football injuries and a majority of these practice injuries are related to live contact tackling and blocking drills. There is little doubt that live contact during football practice is a necessity, but it is also true that the basic fundamentals of football can be taught properly with the use of adequate field equipment and that live contact during practice can be reduced. It has been demonstrated that a limited contact program in practice can significantly reduce the number of injuries and that the limited contact program will not affect the won-lost record of the participating teams. An outline of a sample program involving reduced contact follows:

LIMITED CONTACT PROGRAM

- I. First Week of Practice (helmet and shoes)
 - A. Stress drills for conditioning
 1. Agility drills
 2. Conditioning drills
 - B. Exercises
 1. Stretching and flexibility exercises
 2. Strength exercises (Isometric and Isotonic)
 3. Isometric neck exercises
 4. Bridging exercises for the neck
 - C. Running—start with short distances and increase, both distance and number of sprints daily.
- II. Second Week of Practice (First week in pads)
 - A. Continue emphasis on conditioning drills
 - B. Continue exercises for flexibility and strength
 - C. Continue neck exercises
 - D. Continue to build endurance by running both sprints and distance
 - E. Begin live blocking and tackling drills
 1. Stress proper fundamentals and techniques of execution
 2. Tackler and ballcarrier or blocker and person to be blocked never more than two-thirds of a yard apart
 - F. It is deemed desirable for contact work to be scheduled only to the extent necessary, consistent with the need to teach skill execution. Sled and dummy work should be emphasized for teaching the proper methods of blocking and tackling instead of live contact.
- III. Third Week Until First Game
 - A. Practice sessions limited to no longer than one hour and thirty minutes.
 - B. Scrimmages limited to twice a week (middle and end of week)

- C. Continued restrictions on live blocking and tackling drills with emphasis on teaching proper fundamentals and proper skill execution (Still limit distance between contestants to two or three feet)

NOTE: *No live punt coverage or kick-off coverage*

IV. Practice After First Game Until End of Season

- A. No live full scrimmages
- B. Continue fundamental work on sleds and dummies
- C. No live blocking and tackling activity of any kind.

Coaching Staff

The head football coach is the most important individual when it comes to establishing a successful sports program. His attitude and leadership in promoting the safety factor in football determines whether or not his football program will be successful. Securing a competent and experienced coaching staff is one of the most difficult assignments facing the school administration. If a school or institution cannot provide a well-trained and capable coaching staff, consideration should be given to the elimination of the sports activity from the institution's athletic program.

The head coach is responsible for the total football program and should seek competent and dedicated help. It is the responsibility of the coaching staff to teach the football skills in an environment free from unnecessary hazards. All coaches should take the necessary precautions to assure excellence in the physical condition of their athletes. Proper conditioning reduces the frequency and severity of injuries and increases the morale and the desire of the athlete to compete in wholesome physical activity. The coach who is lax or hurried in the physical conditioning program of his athletes jeopardizes both the athletic program and the health of the student athletes.

Participation in football can foster desirable health habits. The coach should take advantage of teaching situations and inculcate acceptable health practices in his student athletes. There is no place in a football program for the attitude of *winning at any price*, if the health of the student athlete is jeopardized. The encouragement of hazardous and abusive tactics which endanger the welfare of the student athlete should not be tolerated.

A safe football program depends upon careful planning and organization by the head coach. Much of the responsibility for parts of the program may be delegated to other personnel, but the head coach is the final authority in seeing that all phases of the program are conscientiously carried out.

School administrators should evaluate the present status of high school football coaches. These men have the responsibility for the health and welfare of thousands of teenage boys and there are no specified requirements for the position. Current research clearly suggests that coaches with specific types of backgrounds and training are associated with teams that have low injury rates. The variables in a coach's background and training which have been shown to be important when related to injury are coaching experience, level of playing experience, age, education and number of assistant coaches. The information also indicates the need for additional training in exercise physiology and sports medicine.

Facilities

In addition to securing a competent coaching staff, the school administration must also provide excellent playing facilities. The most important facility for a football program is the playing field. The field should be free from all hazards, such as rocks, obstructions, holes, glass and equipment which might cause injury to the participant. Curbings, benches, fences and hard surfaces should be safe distances from the playing field and goal posts should be well padded.

Fields and playing areas require constant attention and maintenance if they are to remain free of hazards that contribute to injury. A well-maintained football field is essential in order to minimize the number of knee and ankle injuries.

The cleanliness of the locker room, training room and equipment room must also be brought to the attention of administrators and coaches. The locker room should be clean at all times with proper space and facilities for the athlete to hang his equipment properly. Facilities should be available for washing and drying the essential parts of the football uniform. A locker room, including shower and toilets, that is not kept clean can lead to an epidemic of staphylococcus infection, and uniforms that are not cleaned daily can be a major cause of boils and infection. The training room is important in injury treatment for inadequate, dirty equipment and facilities will hinder rather than help an athlete respond to treatment. The third area that is important to the health and safety of the athlete is the equipment room. A carelessly kept equipment room is detrimental to football protective equipment and can contribute to injury incidence. The equipment room should be well-ventilated, dry and protected from insects. It is the obligation of the coach to make certain that the above mentioned areas meet all basic sanitary and safety requirements.

Rules and Regulations

Another method of promoting safety in football is to establish and enforce a sound set of rules and regulations. Many unnecessary injuries occur every year because of a poorly defined rule, the lack of a rule, or the improper enforcement of a rule. It is imperative that each school employ competent officials to officiate at interscholastic games. Coaches must instruct their athletes within the rules and must not take advantage of the rules by permitting their players to use abusive and/or hazardous tactics under game or practice conditions.

Athletic governing bodies of colleges and high schools meet each year to promote research to determine the causes of football injuries and vote on rules which enhance the safety factor in football. Rules and regulations governing football are extremely important in the prevention of injury. But of prime importance is the official's responsibility to enforce the rules and the coach's responsibility to coach within the rules.

Equipment

Physicians, coaches, administrators and others responsible for football programs must take it upon themselves to purchase the best protective equipment available. The following comments are a guide to the buyer of football equipment for any age group of athletes: (1) the purchaser must deal with reputable sporting goods manufacturers and representatives; (2) the buyer must purchase the best equipment available; (3) the football athlete must be properly fitted with his equipment; (4) protective equipment must afford adequate protection against the hazards for which it is designed and not create additional hazards; (5) protective equipment must be worn when appropriate and when the football activity demands it; and (6) old and worn equipment should be renovated or, preferably, discarded. The old and worn equipment should never be handed down to players of lesser skill or younger age group teams. All football players should be given the best protection available.

When describing protective equipment for tackle football, special consideration should be given to the helmet. A standardized procedure for the testing of football helmets has been adopted by the National Operating Committee on Standards in Athletic Equipment (NOCSAE). The testing methods and the performance standards required of the football helmets are based on research completed in the Department of Neurosurgery, Wayne State University. The National Collegiate Athletic Association and the National Federation of State High School Associations have both adopted the NOCSAE standards for football helmets. These governing

bodies have agreed that their member institutions shall purchase only those helmets which pass the NOCSAE tests; and beginning with the 1978 season, the NCAA colleges and universities shall use only the NOCSAE approved helmets. The National Federation of High School Associations will use only the NOCSAE approved helmets beginning with the 1980 season.

Although designed as a protective device, the helmet has been used as a weapon in recent years. A practice referred to as "spearing" has developed, that is, driving the head with force into the chest, stomach, and kidney area of an opponent when blocking and tackling. When the human head, encased in a hard plastic helmet, is used as a battering ram, there is danger of hyperflexion, hyperextension, or compression of the cervical vertebrae, as well as concussion. Head and neck injuries, as well as fatalities, have increased since the tactic of spearing was adopted by some football teams. In teaching football tackling and blocking, emphasis should be placed on the fundamental football position (knees flexed, trunk bent, face up, eyes straight ahead). Drills used by coaches in teaching tackling and blocking should employ the fundamental football position with emphasis on the face up. This fundamental football position will place the head in the most desirable position and will likely reduce the risk of serious injury to the head and neck. Blocking and tackling techniques that require the head as the primary blocking surface should be discouraged and eliminated from the game of football.

Enforcement of the rules prohibiting spearing, properly fitted helmets and excellent physical condition are the primary factors which will help reduce fatalities and serious head and neck injuries resulting from participation in tackle football.

Summary

Many injuries and fatalities associated with football can be eliminated or appreciably reduced if the following suggestions are observed:

1. Mandatory medical examinations and medical history should be taken at the beginning of each season before allowing an athlete to participate in any football activity.
2. All personnel concerned with training football athletes should emphasize gradual and complete physical conditioning.
3. A physician should be present at all games and practice sessions. If it is impossible for a physician to be present at all practice sessions, emergency measures must be provided.
4. All personnel associated with football participation should be aware of the problems and safety measures related to physical activity in hot weather.
5. There should be strict enforcement of game rules and administrative regulations in order to protect the health of the athlete. Coaches and school officials must support the game officials in their conduct of football activities.
6. There should be continued emphasis on the employment of well-trained athletic personnel and the provision of excellent facilities and the safest equipment possible.
7. Finally, there should be continued research concerning the safety factor in football.

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Chapter 5

Touch and Flag Football

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More people are playing touch and flag football today than ever before including young people playing on pickup teams after school, adults enjoying a co-recreational game on weekend afternoons, and Saturday morning "powder-puff" games. (Flag football is a variation of "touch" in which each player wears a flag in his belt. The tag is made by snatching the flag of the ball-carrier).

The popularity of this limited contact game seems to have surpassed that of baseball as the number one sandlot activity among youngsters. Young adults as well, have rediscovered the sport which was once known as "sissy" football.

The resurgent interest in touch football is being felt beyond the sand lot level of play. Schools are increasingly inclined to include touch football in their sports programs, and community organizations sponsoring sports activities for youngsters show an increase in touch football league play.

On both organized and informal levels of play activity, it can be estimated that touch football and its many variations are being played today by several million young people, among them a generous sprinkling of females.

Unfortunately, the informal nature of the game together with the wide range of ability, experience, and training of the participants creates circumstances that maximize the accident and injury potential of this activity. On the sandlot, for example, quite often the similarity between what passes for a game of touch and standard touch football is purely coincidental — or accidental, as the case may be.

Teams are made up of those available to play divided as equally as possible. The field of play is generally any accessible area of unspecified size. Rules are informal and subject to frequent change; the only equipment used is a football of some description. Few of the players, if any, bother to warm up with pregame exercises. Older players may not recognize their own limitations for physical activity against younger, more fit players. Younger players may not understand the rules of the game and may be unaware of the hazards involved in playing under poorly controlled conditions.

It is little wonder that accidents and injuries occur under these circumstances. Although there is little specific data available concerning the extent of touch football injuries that occur in organized play and even less in informal play, it is estimated that at least one person a year dies as the direct result of a touch football mishap.

On the other hand, touch football under the supervision of experienced personnel is played according to regulations designed to prevent accidents and injuries. The more sophisticated forms of the game as played in physical education classes, intramurals, or interschool competition at upper elementary, secondary school, and college levels are generally closely supervised and strictly officiated. The rules are adapted to the limitations of the players who may be

equipped with essential protective garb, who are teamed according to size and ability, and who have been coached and instructed in proper play and safety techniques to minimize accidents.

In spite of precautions, however, even under supervised play, injuries continue to occur. It is estimated that about 5,000 of the 350,000 male college students who participate annually in intramural touch football are injured seriously enough to seek medical attention (1). Figures are not available for other age groups probably because the informality of the game precludes routine reporting, analysis, and publication of data.

Hazards

A few investigations, mainly on the college level, have been made into the character of the injuries sustained by touch football players (2,3). A close look at the nature and extent of these injuries is revealing.

Studies conducted at Michigan State University involving nearly 15,000 participants showed that bruises, sprains, and cuts were the injuries occurring most frequently in men's intramural touch football (3). Most of the injuries involved the head, face, shoulders, knees, and ankles and were of a minor nature with only a small percentage considered serious.

The majority of the injuries resulted from collisions, action in blocking or being blocked, falling, and being struck by another player's elbow. Injuries caused by falls were most commonly bruises and strains. Where injuries occurred through blocking action, they were mainly bruises. Injuries from collisions were also bruises, and cuts. When a player made severe enough contact with another player's elbow, the injuries were most often bruises and cuts or damage to the teeth.

The injury frequency rate of touch football is consistently higher than that of most other intramural sports. The touch football injuries alone at Michigan State University accounted for nearly one-half of the total number of injuries in the school's entire men's intramural program.

Prevention and Control

Examination of available information concerning accidents and injuries sustained through playing touch football indicates some direction toward prevention and control of accidents and injuries.

Since the action that most often leads to injury in touch football is collision with an opponent or a teammate, players should anticipate the probable action of others around them and be prepared to move out of the way or know how to cushion unavoidable body contact. Rules concerning blocking action should be strictly enforced by officials, and players should be cautioned with regard to the severity of the blocks they use.

To prevent falls and the injuries resulting from falls, a player should know the basic principles involved in falling without sustaining injury. He should understand the relationship of the center of gravity to body control, how to establish a wide base of support, and how to spread the impact of a fall over a large surface area of the body. The player needs also to know how to flex his joints properly in order to absorb the shock of landing and how to relax and roll as he falls.

Since high percentages of injuries occur to the head and face, the use of properly fitted headgear, face guards, and mouthpieces should reduce the frequency and severity of injuries to these areas.

However, the use of such protective equipment can engender a false sense of security and safety among the players, with the result that the game can be rougher and injuries may continue but with greater severity. Similarly, the use of an elbow guard may cut down on cuts and bruises, save teeth, and help protect a player when he falls. On the other hand, it may also encourage more reckless play and thereby increase injuries.

There is considerable controversy concerning the value of certain kinds of protective equipment for use in touch football. Research studies concerning the design and effectiveness of protective equipment are needed.

In addition, certain basic safety measures can be instituted in the formally organized sports program and are recommended for carry-over into pickup games.

1. Apparel appropriate for the game should be worn, with sneakers and nonrestrictive clothing recommended. Objects such as pins and pencils in pants pockets should be removed. Spiked or sharp cleated shoes should not be allowed.
2. A player who wears glasses should wear the kind designed for safety with shatterproof lenses and safety frames. In addition, the hinges and bridge areas should be padded or taped.
3. Players should be conditioned before playing and should have a sufficient warm-up period before each game. An individual recently recovered from an illness or disability should first see his physician to establish his readiness to resume play. Medical examinations and proper follow-ups should be given to all participants in school supervised touch football.
4. The playing field should be free of holes, stones, or other obstacles that might contribute to injury. It should be well marked and large enough to accommodate freely the size of the group using it.
5. Rules should be modified to accommodate the size and ability of the players, and all of the players should understand the rules clearly. The game should be regulated by strict enforcement of the agreed upon rules.

Even after all safety measures have been taken, accidents and injuries will occur. Most of these will be minor, but some will be serious. The responsibility of adult leadership is to minimize the frequency and severity of these injuries.

Physical education teachers should teach the fundamentals and safety skills of touch football at the appropriate grade levels. They should instill in youngsters the proper social attitudes that will encourage them to participate safely and with enjoyment in pickup games on the neighborhood playground or in their own backyards. Other leaders of youth activities have a similar commitment to the safe conduct of the touch football games that they supervise.

Touch football can be a relatively safe activity. Only when it is played with lack of regard for the rules and lack of respect for the safety of the players can it be considered a dangerous sport.

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Chapter 6

ICE HOCKEY

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Hockey has been recognized as being perhaps the fastest team game and certainly one of the roughest. Injuries are often an accepted part of the game and players are frequently expected to continue with disabilities that would keep their counterparts in other sports on the inactive list for weeks. There is a prevailing attitude against taking known preventive measures because of the expectation of roughness and the possible slur on the manliness of the player. Young boys are asked to play like the professionals, often under the rules of the professionals, but without the necessary skills of the professionals. In addition, the equipment of youth is nearly always inferior to that of their heroes.

In hockey especially, "fighting, roughplay, and dirty tactics may be normative, expected forms of conduct — it is learned during the socialization of the youngster and it is part of the role expectations of the player." (12:9-10). Thus, illegal tactics and tricks of the game are both encouraged and taught, to put star players out of action. Old time sportsmanship and a deemphasis on winning could help decrease the injury problem, but the codes of conduct of coaches, players and parents must first be revised as a part of our social expectations. The spirit of the game must be returned to join with the letter of the game. While we have failed to maintain the differences between the professional and amateur nature of the game, adults are the primary reason. Most minor hockey coaches have no concept of coaching other than the image portrayed by the professionals, and often it is easier to stress aggressiveness and violence than to *teach* skills. The coach is so important as a teacher and formulator of attitudes, and yet so little attention is paid to his qualifications. He can easily affect the player's self-image, relationship with peers, attitude toward authority, concept of sport, and ability to cope with success and failure. (9). Officials are almost as hard to find as coaches for our youth leagues, and their lack of experience and consistency can lead to frustration, anger, and a desire to retaliate by players.

Yes, hockey is a fast moving contact sport in the truest sense and a certain number of injuries is unavoidable. Most of the injuries are minor, consisting of bruises and lacerations. Unfortunately there are several major injuries each season and the occasional fatality does occur. The first fatality in the 51-year history of Canada's National Hockey League was attributed to a massive internal brain injury suffered by a player when his head slammed onto the ice during a recent game. The player would probably be alive today if he had worn a helmet. Has the tragedy led other NHL players to switch to helmets? No! Only a few would rather wear them than risk permanent injury or death.

Although this was the first fatality in the NHL, there have been many deaths outside the League. In 1966, a 30-year-old Ontario school-teacher died 10 days after suffering a head injury in a game between teachers and students. In 1965, a student from McMaster University in Ontario died of head injuries after lying in a coma for three weeks. In 1963, a 26-year-old

minor league player died of head injuries in Ottawa. (2:43) In 1973-74 fatalities occurred in Detroit, Michigan in a bantam game; in London, Ontario, in a youth hockey practice scrimmage; in rural Ontario in a men's recreational league game.

The list runs on and on, with the majority of hockey fatalities resulting from head injuries. Needless to say, there have been many near misses where the injured player suffered only a mild concussion. Most of these injuries and fatalities could have been prevented with the use of good hockey helmets but players will not wear them. Most players complain of profuse perspiring, impaired vision, or lack of comfort. Some feel that helmets make them look like sissies or that they lose their individuality on the ice. Protective equipment prevents injury and re-injury; however it may give a false sense of security that encourages self-induced injury or injury to others. Helmets, and more recently face masks, have become more acceptable, especially in youth hockey, but where given a choice, many refuse to wear this proven protection. The only way to protect all hockey players from major head injuries is to make the wearing of a helmet compulsory at all levels, in practice as well as in games! The Amateur Hockey Association of the United States (AHAUS) has just recently required helmets to be worn in their youth leagues.

How dangerous is ice hockey? Whether the player is an expert who skates on two thin blades at speeds in excess of 30 miles per hour, or a young child maneuvering unpredictably at five miles per hour, the potential for injury is great.

The Injury Picture

Of all the major sports played in North America, ice hockey has the least research related to injuries and the poorest kept records. Even in Canada, hockey capital of the world, few teams or leagues keep injury records. The only way to obtain an idea of the type and extent of injuries is from personal experience and observation or through discussions with coaches and players. Most articles and books written about hockey devote little or no attention to the accident problem. Clarke criticizes this when he notes that little scientific controlled research into the effects of recommended controls in sport and resultant injuries exist. (1:45)

Most hockey injuries are minor. Cuts about the face and loss of teeth are the most common. This type of injury is caused primarily by being hit with a stick or puck. Occasionally players are cut by skates when they fall or are knocked to the ice. The latter is more prevalent in beginning hockey since novices are awkward on skates. Although these injuries can never be totally prevented, they can be minimized by the use of helmets and mouthpieces; good officiating to minimize high sticking, slashing, and cross-checking; and the coaching of players to protect their head and face with their arms and gloves when knocked to the ice or into the boards. Pollard analyzed hockey accident records at Dartmouth College accumulated over a period from 1934-1966, and confirmed that soft tissue injuries to the head and face are the number one problem (11) Mathe further stressed the preponderance of head injuries when he reported that 47.3% of all hockey injuries in a 1948-1951 Czechoslovakian study were to the head (8) Further major studies related later in this chapter support the emphasis on injuries to the face and head, yet research into the construction of lightweight, airy, heat-dissipating helmets has been minor. In 1974 the Ontario Amateur Hockey Association rulings made strict standardization of one piece suspension helmets mandatory for protection against falls and sudden stopping by being thrust into the boards. Mouth protectors and face guards are still a step behind. When will adequate stress be given to the minor equipment additions needed to eliminate almost one half of all hockey injuries? Head and face injuries, including those to the teeth, may be more serious than a fractured arm or leg.

Goalies in hockey have a special problem. Although wearing a mask is more common now, many leagues do not make it compulsory. This is the only way to protect goalkeepers from flying pucks, high sticks, and scrambles in front of the net. Goalies also have the unique

occupational hazard of groin injuries while doing splits and hand injuries from catching the puck. Proper conditioning and warm-ups will minimize the former.

Corbett, Coach of the University of Western Ontario hockey team, stresses isometrics and weight training for all his players and insists on at least 15 to 20 minutes of pre-game warm-up. He states that just as many injuries occur in practice as in games so that the same precautions should be observed. Corbett warns about the increased injury problems that occur late in the season, late in a game when the players are tired, and during playoffs. He recommends quicker line changes to help alleviate this problem.

Hockey players are afflicted with other injuries which are either not too serious or rare in nature. Bone bruises, especially around the ankle from being hit by a puck, are common but not serious. Equipment of good quality and proper fit can minimize this problem. Few players, for instance, wear ankle protectors, shoulder and elbow pads, or proper thigh and slash guards. There is no excuse for not using protective equipment when it is available.

Other hazards unique to hockey include striking goalposts that are too rigidly attached. Many other goals have long pipe insertions. Short ones should be substituted so that if they are hit forcefully the cage will move. For young hockey players the goals do not need to be attached at all.

Many hockey players are injured because spectators throw coins, paperclips, paper, eggs, ink, paint, wood shavings, and other objects onto the ice. Only proper supervision of crowds by the arena management or local police, and education of the spectators about the injury problem, can prevent this needless hazard.

Toronto Study (7)

In a 1963-64 a Toronto Township Hockey League study of 2,469 players, ranging in age from 7 to 18 years, all injuries requiring a doctor's services were analyzed. Principal distribution of the 85 injuries were as follows: mouth 25%; eyes 15%; nose 10%; head and forehead 18%; knees 7%; wrists 6%; ribs 3%; ankle 3%; fingers 3%. The main causes of these injuries can be summarized as follows: sticks 25%; puck 19%; skates 9%; striking the boards 17%; falls and body checks 13%. Whereas, head and facial injuries were caused primarily from being struck by a stick, puck, or skate, body injuries generally resulted from a check or fall. The age of the participants did not correlate with any particular type of injury, although body injuries were more common among the 14-to-18-year-olds.

The Toronto Township Hockey League requires helmets and mouthpieces for all hockey players. Consideration was given to using a face bar on helmets but no decision was made. However, two rules were modified in an attempt to minimize facial injuries. First, sticks must be carried below waist level. Second, the slap shot was outlawed since the stick is raised quite high on this shot. Since 50% of the body injuries are caused by checking and hitting the boards, more vigorous rules enforcement regarding body checking and boarding was recommended. Also, referees were instructed to be very fast on the whistle, especially on the boards and around the net.

Doctors Study Hockey Injuries (3)

The Ontario Medical Association Section on Sports Medicine study of hockey injuries in Ontario was reported in 1974. After a 1971-72 pilot study, a province-wide survey of hockey injuries to 15-21 year old players was conducted during the 1972-74 seasons. A total of 542 injuries to 530 players were reported and analyzed. All reports combined documentation by the coach or manager and the attending physician. As shown in Table 1, most injuries were of a minor nature with only one third being of a disabling character.

TABLE 1
NATURE OF INJURY ^a

NATURE	NUMBER	PERCENT OF TOTAL
Laceration	149	27.5
Contusion	124	22.9
Fracture	108	20.0
Dental	68	12.5
Ligament	42	8.0
Concussion	29	5.3
Dislocation	13	2.4
Eye	9	1.7
TOTALS	542	100.3

^a From Hastings *et al.* (3:687).

This study also indicated that there was no relation between the player's position and his risk of injury. However, a question was raised about the apparent over proportion of injuries occurring behind the net in relation to the percentage of ice surface in these areas.

Ninety-six percent of the lacerations occurred about the head and neck in spite of the wearing of protective helmets which were mandatory in the age group surveyed. However, face protectors were not required in this, or other age groups. High sticking caused 68 percent of this type of injury. While large in number, only eight of the 149 injuries resulted in disability of any significance. The majority of contusions were caused by being knocked into the boards and occurred mostly about the shoulder, knee, elbow and back. Being struck by a stick was the second leading cause of contusions, almost 25 percent. Fractures occurred overwhelmingly in the hand (27%) indicating the need for better protective gloves. Fractures of the clavicle (16%), nose (13%), forearm (14%), and ankle (12%) were other major areas of exposure. Being hit by the stick (23%), opposing player (23%), and boards (26%) caused most of the damage. While dental injuries accounted for only 12 percent of the injuries, the stick was responsible for 75 percent of those injuries. Since mouth pieces are required of this age group, obvious research needs for better protection, perhaps combined with a general face guard, are indicated. Of the 42 ligament injuries, 23 were to the knee, and this was the only site where surgery and hospitalization was necessary, and that occurred in four cases only. Of the 29 concussions, 17 came from falling on the ice or into the boards. Better helmets are again indicated here. (3:689-90)

From an overview of all injuries, Table 2, it is obvious that the stick was the most common agent responsible for injuries. This can easily be controlled by referees calling highsticking and slashing penalties more frequently. Since most of the more serious injuries were also produced by swinging the stick at an opponent, cause exists to make such incidents a major, rather than a minor, penalty.

The following recommendations were made by the authors.

1. Pad the end of the stick and eliminate shoving of the back;
2. More strict enforcement of high sticking rules;
3. Use of shock absorbing material behind the boards;
4. Increase the distance from the goal line to the end boards;
5. Make a combined face and eye protector included in helmet design.

TABLE 2
ANALYSIS OF MECHANISMS OF INJURY^a

NATURE	Stick	Puck	Skate	Ice	Opposing Player	Fights	Boards	Goal Posts	Total
Laceration	102	19	11	7	3	3	3	1	149
Contusion	29	23	3	15	12	3	35	4	124
Fracture	25	8	0	13	25	7	28	2	108
Dental	51	5	1	1	4	1	5	0	68
Ligament	0	2	0	13	11	3	12	1	42
Concussion	6	2	0	10	2	0	7	2	29
Dislocation	0	0	0	3	6	0	4	0	13
Eye	8	1	0	0	0	0	0	0	9
TOTAL	221	60	15	62	63	17	94	10	542
Percent of injuries	41	11	3	11	12	3	17	2	100

^a From Hastings *et. al.* (3:691).

A University Study

Don Hayes (4) conducted a study of hockey injuries during the 1970-71 season for 21 Canadian and nine American universities, including 212 and 68 games, respectively. He considered many variables in his study resulting in some of the following observations:

1. The number of injuries per game decreases as the season progresses;
2. The position played is a statistically significant variable at the .05 level in the extent of injuries with forwards having 61%, defensemen 32% and goaltenders only 7%;
3. The first period has significantly fewer injuries (.05) than either periods two and three;
4. 85% of the injuries are accidentally caused and do not have a penalty associated with them;
5. Fighting for the puck (23%) and being checked (24%) are significant (.05) activities associated with injuries when compared to all others;
6. Body contact (38.2%), stick (29.1%), and puck (15.2%) cause most injuries;
7. The zone of play is not a factor in injury production;
8. Less than 7% of the injuries result in unconsciousness and in 55% of the injuries, the athletes continue to play in the game;
9. Most injuries are minor with 52% of the injured returning to the game in five minutes or less, and only 29% out for at least the rest of the game;
10. Condition of the players, ice surface, equipment and unfamiliar playing position were not significant factors in the causes of injuries;
11. Contrary to popular opinion, there was no relationship between injuries and the score of the game.

The location of 328 injuries in this study compare favorably with that of the physicians' study. The head and face account for over 45% of all injuries, and this location is significantly greater than any other at the .05 level of confidence. (4:77) Sticks caused most injuries to the head, face, arms, hands and upper legs. Board checks caused most neck and shoulder injuries, while the puck was most often associated with injuries to the lower leg, ankles, and feet. While most of the injuries to the head and face were soft tissue lacerations, there were also 10 concussions, 8 dental, and 3 fractured noses.

TABLE 3
DISTRIBUTION OF INJURIES RELATIVE TO ANATOMICAL LOCATION ^a

LOCATION	FREQUENCY	PERCENT OF TOTAL
Head and face	148	45.1
Neck and shoulders	30	9.2
Trunk	29	8.8
Arms and hands	26	7.9
Buttocks, hips, groin	11	3.4
Upper leg	18	5.5
Knee	34	10.4
Lower leg	5	1.5
Ankles and feet	27	8.2
TOTALS	328	100.0

^a From Hayes, (4:77).

While most injuries were minor with more than 81% of them resulting in players being out of action for two days or less, serious injuries did occur (Table 4). Fighting (25%) and stick related penalties (20%) related most frequently to these injuries. This is a marked variance from the study by Hastings *et al.*, (3) and could be due to the age level being studied or to variations in rules. This writer recommends better equipment to protect the head, face, shoulders, and knees, and better rule enforcement for high sticking and boarding.

TABLE 4
DISTRIBUTION OF INJURIES BY CLASSIFICATION ^a

CLASSIFICATION	FREQUENCY	PERCENT OF TOTAL
Abrasion	3	0.9
Laceration	93	28.4
Contusion	156	47.6
Strain	16	4.9
Sprain	21	6.4
Fracture	15	4.6
Dislocation	9	2.7
Other	15	4.6
TOTALS	328	100.0

^a From Hayes (4:78).

The Role of Violence

A rash of violent outbreaks in junior and minor hockey in Ontario during the 1973-74 season prompted the Director of Sports and Recreation for Ontario to request an investigation into this aspect of the game. The resulting report by McMurtry (9) has caused great furor in the Province and several rule changes. The investigation resulted in the listing of seven basic causes of violence that threatens to ruin the game of hockey, and which may very well contribute to the injury situation.

1. The influence of professional hockey, especially the NHL, with the emphasis on winning, the use of violence to achieve victory, intimidation outside of the rules, and the promotion of the sport by "selling" brawling;
2. The structure of the rules which allows blatant interference, holding, tripping, slashing and the like, thus laying the foundation for fighting;
3. The lack of definition of objectives and purposes for amateur hockey has resulted in a wide variety of philosophies by coaches and parents alike, thus contributing to the "win at any cost" philosophy;
4. The referees are poorly trained, do not enforce the rules, are inconsistent, and generally receive little respect from players, coaches, organizations, or fans;
5. The coaches are mostly volunteers who need more guidance and help via clinics. They fail to support the officials and lack control over their players.
6. The majority of players lack respect for the rules and officials;
7. The parents and coaches are poor models of control and place undue pressure to win on the players. (9:20-35)

McMurtry concludes that hockey must be returned to a game of fun where fighting is eliminated or at least well controlled as in the NCAA. Clinics must be sponsored for coaches and officials and coaches must be made responsible for players conduct via penalty or suspension. A philosophy of play needs to be developed that does not stress winning, intimidation, and verbal abuse. Rules need to be made more strict and enforced better. Fans, especially parents, must be educated in the skills of the game. Finally, he recommends that hockey be placed more in the schools and taken out of the community orientation which currently lacks control.

Conditioning

As in any sport, proper conditioning before and during the season will minimize injury. L'Heureux mentions several special conditioning exercises for hockey players. (6) He advocates trunk flexion exercises to meet the strain of holding a bent position on skates. Also, ankle, foot, and knee stretching aids in carrying the load of the body on skates. Skating uses muscles unique to the sport because a player moves on the ice with a semi-sideways leg push. Side leg raises with a weighted boot or manual resistance greatly strengthen a player's skating ability. Hopping on one leg and heel raising strengthen the ankles. Jeremiah advocates working on the adductor muscles to give much needed strength to the groin muscles. (5)

Of course there are many other exercises that are beneficial in conditioning for hockey as well as for other sports. Running and skipping helps the legs. Stops and starts are excellent leg strengtheners. Pushups and chinups will strengthen the arms, wrists, and shoulders. Wrist curls with a barbell improve shooting. Since balance is so important, ballet work in preseason drills, with and without skates, will minimize falls and checks.

In *The Hockey Handbook*, a must for coaches and players, Percival describes many more team and individual drills. (10) He criticizes poor warm-ups as a major cause of injuries. Warm-ups should be strenuous enough so that every player is sweating heavily before the game starts . . . However, particularly at low level organized hockey, there is sometimes insuffi-

cient time for a good ice warm-up . . . Special warm-up exercises should be done in the dressing room before the skates are put on. (10:306-07)

Equipment

Hockey equipment available today can do a great deal to prevent or minimize injuries if a player uses it properly. Too often a young player who is growing rapidly is using ill-fitting equipment which does not protect him properly. This is particularly true of pants and skates. Those which are too large or too small will hamper the player's skating and make him more vulnerable to injury. Many young players do not wear an athletic supporter with a metal cup. This can result in serious injury to even the youngest of players. Often insufficient underclothing is worn and the player is without proper warmth or absorption protection. Stockings, shin pads, pants, elbow and shoulder pads, sweater, gloves, helmet, mouth guard, athletic supporter, skates, and stick should be standard equipment for hockey players of all levels.

Hockey players use large amounts of tape to keep equipment in place. If the shin pads, in particular, are allowed to slip, injury possibilities are greatly increased. Also oils put on the feet help toughen the skin and prevent blisters and sores which are so common early in the season. Cotton or rubber pads inserted under the skate tongue prevent lace soreness.

Goalies have special equipment needs. In addition to the equipment worn by other players, a goalie must have arm, shoulder, and leg pads, a mask to protect him against facial cuts and a chest protector to safeguard against bruises and possible broken bones when hit by the puck. A goalie also needs extra padding in the thigh and hip areas of his hockey pants.

Officiating

As in other contact sports, officiating is extremely important to prevent injury. At least two officials should be used in all games. If there is only one official, he will probably miss the multitude of illegal tactics such as holding, interfering, slashing, and so on which in themselves may not cause injury but which tend to irritate players into more violent retaliatory actions such as cross checking, high sticking, elbowing, charging, boarding, etc. Officials must be strict and consistent on all types of fouls, not just those which have the greatest possibility of causing direct injury.

Many players are unaware of the rules. It is a valuable service to players, coaches, and other officials if at least one practice session is devoted to reviewing the rules, especially those which have been recently changed. Most officials find it well worthwhile to spend this time with a team before the season begins.

Tips for Injury Prevention

1. Keep your head up at all times. Learn to stick handle and pass the puck without watching it.
2. Practice improving your peripheral vision so that you are aware of the total picture and where each player is situated.
3. Develop instinctive maneuvers in the corners and along the boards to prevent serious board checks.
4. When falling or being hit into the boards, protect your face and head with your arms and gloves.
5. Try to absorb the impact when hit by an opponent unless the combination of your size and speed is much superior to his.
6. Spread out on the rink. Do not overcrowd.
7. Do not lean on your stick. If you depend on your stick to keep you upright it is too easy to upset your balance.

8. Keep your stick below your waist and your elbows in. This will prevent injury to others and eventually to yourself.
9. Keep moving on the ice. A stationary target is the easiest to hit.
10. Wear properly fitting protective equipment at all times. The one time you forget may be the time you are injured.

Conclusions

The case of Forbes vs. Boneba has set in motion forces which should lead professional hockey to the control of violence in the sport. However, whether they will filter down to amateur hockey immediately is debatable. Hockey at all levels needs to take the initiative to control the players, coaches and fans for the sake of injury prevention. Rules must be enforced more stringently, and players and coaches who continue to abuse the rules should be suspended from competition. New equipment modification especially in the protection of the head and face are a must to reduce injury. Some of the rules of the game for youth could be modified to discourage checking. Injury prevention runs hand-in-hand with enjoyment of the game and is the responsibility of all.

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Chapter 7

LACROSSE

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Grantland Rice, the legendary dean of American sportswriters, in describing lacrosse was quoted as follows:

Once in a while they argue about the fastest game — basketball or hockey; then about the roughest game — water polo, football, or boxing. But when it comes to the top combination, the answer is lacrosse. Lacrosse is the all-star combination of speed and body contact. It requires more elements of skill than any game I know. (2)

Although this colorful description of lacrosse accurately portrays the speed and skill of the game, it is misleading and often misinterpreted, with regard to its roughness. It is common to find in a magazine or newspaper article on lacrosse a reference to this roughness in either the title or theme of the story. Some examples are:

"Massacre on a Muddy Plain," "Mayhem on the Lawn," "Moral Substitute for War," and "The Roughest Sport of Them All."

There is no doubt that lacrosse is a highly competitive sport involving contact and ruggedness. But the idea that lacrosse is "mayhem on the lawn" and "blood on the green" and therefore unsuitable for physical education and varsity activity is erroneous.

Injury Potential

Gallagher of the Children's Medical Center in Boston commented on the extent of lacrosse injury, based on a survey of all injuries over a period of seven years at a boys' preparatory school:

On the comparative basis of average number of injuries per participant per year, there is little difference between soccer, basketball hockey, wrestling, baseball, and lacrosse . . . that baseball had more injuries than lacrosse may surprise those who have seen lacrosse played. It can be explained by the fact that lacrosse, as played in preparatory schools (at least in New England), is strictly refereed in an effort to keep injuries down, and because the obvious roughness is not of the kind which frequently produces injuries; to slash at your opponent's stick may seem dangerous to a spectator, but it only rarely injures a player. The number of eleven-man football injuries averaged more than eight times as many as for hockey and lacrosse . . . (1:201)

Based on communication with the Board of Education of Baltimore County, Thomas stated that although the lacrosse stick is a potentially dangerous weapon:

. . . in the hands of skilled players the number of serious injuries is small. A large public school system in the State of Maryland had approximately 2,700 players participating in lacrosse from 1956 through 1966 with 282 reported injuries during this ten-year period. This is an injury rate of less than 1 percent. . . . (3:550)

Common Injuries

Most of the injuries that occur in lacrosse are contusions, either minor or major. The area receiving the greatest trauma is the forearm and elbow, as the defender in attempting to dislodge the ball from the offensive player often makes contact with his stick in these areas. Slashing with the stick or body blocking can also cause contusions to the unprotected quadriceps muscles. The goal keeper is particularly susceptible to contusions to all parts of his body as a result of blocking shots at the goal. Contact with the ground or opponent frequently cause minor abrasions, and most lacerations are also minor in nature.

Although fractures are not too common, they may occur in the bones of the hand or of the clavicle — either as direct blows by the stick or a shoulder block. Likewise, injuries to the mouth or teeth can happen. Cerebral concussions are uncommon, and in the Maryland public school study, only three mild concussions were reported in the 282 injuries. (3:551)

Since lacrosse is a game of running, jumping, dodging, throwing, catching, scooping, *etc.*, sprains and strains of joints and muscles will occur — particularly in the ankle, knee, and shoulder. Knee and ankle injuries often occur when cleats get caught in the ground and the knee or ankle is twisted. Most teams have switched from football shoes to soccer type shoes because of the shorter cleats which decrease the risk of locking the shoe in the turf. On artificial surfaces, many teams prefer to wear non-cleated shoes or specially made shoes for traction. Shoulder sprains and dislocations can occur in throwing and blocking.

Serious muscle strains have a tendency to recur and can cause prolonged disability, particularly if they occur in the quadriceps or hamstring muscle group.

As far as chronic injuries are concerned, those most common are seen in the ankle joint, knee joint, and shoulder girdle. According to Thomas:

Many of the chronic injuries result from complication in acute or subacute injuries to specific anatomical parts. Chronic injuries result from acute or subacute injuries that have been improperly or inadequately treated, improperly diagnosed, or result from a player returning to competition before the acute injury has healed and before the player has received proper rehabilitation therapy. (3:622)

A study of lacrosse injuries at Duke University was made during an 11-week period, (mid-January to the beginning of April), during the 1975 season. The findings showed that sprains constituted 46% of the injuries, strains-43%, and fractures and dislocations-11%. The area in front of the goal was the most hazardous as 52% of the injuries occurred there, 28% occurred in the midfield, 10% in the restraining area, and 10% behind the goal. Most injuries occurred during the first quarter — 54%, while 29% occurred in the fourth quarter, 13% in the second quarter, and 4% in the third quarter. (4)

Keys to Prevention of Injuries

Participation in lacrosse, as in any sport, involves a certain amount of risk. However, close attention to the following areas will help to minimize risks of injury.

- Medical.** 1. Physical exam — A complete medical evaluation, (examination and history), at the beginning of each season should be mandatory before an individual is allowed to participate.
2. Insurance — All participants should be covered by some type of accident insurance, either a personal policy or a school policy.
3. Supervision — All practice sessions should be under the supervision of the head coach or one of his assistants and a qualified trainer should be present for all practices and games. A doctor should be on call during all practices and present at all games.
4. Injury reports — A report should be filed daily on all injuries and sicknesses that occur. The report should be all inclusive regarding: nature of injury, how and when it occurred,

medical diagnosis and disposition, recovery or rehabilitation program, etc. This log should be kept on file in the training room for daily reference and end of season evaluation. (See Figures 1 and 2 for examples of report form and log of injuries)

- Conditioning.** 1. Importance — Proper physical conditioning which develops strength, endurance, and flexibility can reduce the frequency and severity of injuries. It also affects the participant's ability to play, his mental attitude, determination, spirit, and teamwork.
2. Type — Lacrosse is a game of speed, agility, coordination, and endurance; and exercises should be undertaken that will develop the body for peak efficiency in these areas. Distance running and running stadium steps will develop endurance, while wind sprints will develop speed as well. Agility drills will help strengthen ankles and knee joints and should as nearly as possible simulate actual playing situations. Calisthenics involving stretching, twisting, and bending exercises will increase flexibility.
3. Pre-season — Workouts should emphasize improving the cardiovascular and respiratory systems. All the players should be made to understand the importance of being in top physical condition throughout the season. Since a lacrosse player is required to run many sprints during a game with little time for recovery, he will be accumulating an oxygen debt. If he reaches his maximum debt, he will be unable to perform. Therefore, teams that can rest their players often enough for them to recover from this oxygen debt, without the team suffering a decrement in performance by the substitution, will have greater success.
4. Warm-ups — A sufficient amount of time should be allotted for a thorough warm-up before each practice session and game. This will reduce the risk of muscle strains. Care should be taken that those players who come late to practice also properly warm-up before participating. Warm clothes should be worn in early season and when weather conditions dictate it.
5. Rest — During hard practice seasons and in hot weather, rest periods and water should be provided. Salt tablets should also be taken to maintain the saline balance of the body during periods of high temperature and humidity. This will lessen the fatigue and the probability of an accident, and reduce the possibility of heat cramps, heat exhaustion, or heat stroke.

- Coaching and officiating.** 1. Fundamentals — Coaches are responsible for the correct execution of fundamentals and playing techniques so that not only is efficiency improved, but the risk of injury is lessened.
2. Ethics — Close supervision by a coach on legal stick and body checking, and the proper attitude instilled in players will eliminate injuries caused by unsportsmanlike actions.
3. Officiating — All contests should be played with qualified officials who will enforce the rules governing illegal and dangerous play.

- Equipment.** 1. Required — Official rules, (for men), require that every player in the game have a helmet, face mask, properly fastened with chin strap, and gloves in order to participate. With the improved full face mask eliminating most facial cuts, and when arm and shoulder pads are worn, few injuries occur on the protected parts of the body. A new rule has been proposed for the 1976 season making the wearing of shoulder pads mandatory. It is also recommended that mouth guards be worn. The coach should insist that all protective equipment be worn in practice as well as in a game.
2. Condition — Equipment should be periodically checked, and items that are worn out, broken, or potentially dangerous replaced.
3. New — More laboratory testing programs on protective equipment is needed.

Fields. All practices and games should be played on non-hazardous fields. Fields should be continuously checked for ruts, holes, broken glass, and other obstacles that might cause injuries.

Intramural Programs

Cadets at West Point are required to wear mouth pieces and have their ankles taped in addition to wearing the regular equipment prior to participating in intramural lacrosse. The officials are required to inspect each man prior to the game to insure that he is wearing serviceable equipment. In addition all cadets having a history of knee injury, concussions, etc., must receive a medical clearance prior to participation, and cadet trainers are assigned to each game. These measures were responsible for the low injury rate in 1967 intramural lacrosse:

- 460 Cadets scheduled
- 3,680 Total exposures (each cadet 1 hour per day for 8 days)
- 42 Injuries (33 lower, 9 upper extremities)
- .011 Injuries per exposure

At the Air Force Academy, the intramural office considers lacrosse one of its safest sports. They averaged two fractures a year, and the rest were sprains, strains, and various bruises. With one team of 18 to 24 men per cadet squadron, the injury rate during a four year span was as follows:

- 1964 — 68 injuries — 24 squadrons
- 1965 — 75 injuries — 24 squadrons
- 1966 — 70 injuries — 24 squadrons
- 1967 — 62 injuries — 30 squadrons

The intramural program at John Hopkins also includes lacrosse as one of its activities. The school provides helmets and gloves, and pays student officials to referee the games. Injuries have been minimal in this highly competitive program.

Physical Education

In the physical education program at Johns Hopkins, a modified game is played without protective equipment. The rules allow no body-checking or poke or slap checking with the stick. It is legal to check with the head of the stick only on the opponent's head of the stick. Also, the dimensions of the field are abbreviated. There have only been a few minor bruises in the 20 years lacrosse has been in the program.

Duke University introduced lacrosse, in combination with soccer, into its physical education program eight years ago and it has been enthusiastically received by the students. The basic fundamentals are taught and practiced through drills and relays with just sticks and balls. Later, modified games, under close supervision by the instructor, are played on either the full field or half field. Rule modifications are similar to those at Johns Hopkins, and there has been no injury problem.

Summary

Although lacrosse may appear to be a wild, free-swinging, accident prone game, in reality it is a vigorous activity that requires more athletic skills than most other sports. With the rules that exist today, good officiating, improved equipment, (properly maintained), a sound conditioning program, and ethical coaching, the injury and accident potential can be minimized. Lacrosse can be safely played in the physical education and intramural program, as well as on the varsity level. In looking for a new activity that is fun to play and combines the physical fitness elements of speed, endurance, agility, coordination, reaction time and courage, serious consideration should be given to lacrosse.

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Figure 1
DUKE UNIVERSITY
INTERCOLLEGIATE ATHLETICS
INJURY OR ILLNESS REPORT FORM

NAME: _____

TEAM: FB BK BB
 SOC SW LX
 WRE. FN TR
 IM PE TEN

Year: 1 2 3 4 5

AGE: _____

NATURE OF ILLNESS-INJURY:

ABRASION _____
 CONTUSION _____
 CONCUSSION _____
 DENTAL _____
 DISLOCATION _____
 FRACTURE _____
 LACERATION _____
 PUNCTURE _____

SPRAIN 1 2 3

STRAIN 1 2 3

HEAT STROKE _____

HEAT EXHAU _____

OTHER _____

LOCATION OF ILLNESS-INJURY:

HEAD _____
 FACE _____
 NECK _____
 CHEST _____
 ABDOMEN _____
 G U TRACT _____
 BACK _____
 SHOULDER _____
 CLAVICLE _____
 U ARM _____
 ELBOW _____
 F ARM _____

WRIST _____
 HAND _____
 FINGER _____
 PELVIS _____
 ILIAC CREST _____
 HIP _____
 THIGH _____
 KNEE _____
 L LEG _____
 ANKLE _____
 FOOT _____
 TOE _____

OTHER _____

HISTORY OF ILLNESS-INJURY:

HOW INJURY OCCURRED: _____

ACTIVITY: **GAME** **SCRIMMAGE** **PRACTICE**
 OFF. **DEF.** **FUND.**

IMMEDIATE TREATMENT: _____

MEDICAL REFFERAL

TO: DR. _____

LOCATION: _____

DATE: _____

TIME: _____

THIS ATHLETE IS REFERRED TO YOU FOR DIAGNOSIS, TREATMENT, AND FOR RECOMMENDATIONS

DUKE HISTORY NUMBER: _____

**AUTHORIZING
SIGNATURE:** _____

Athletic Trainer

DIAGNOSIS: _____

RECOMMENDATIONS: _____

SIGNATURE: _____

PLEASE RETURN THIS WITH ATHLETE

Figure 2
DUKE UNIVERSITY
INTERCOLLEGIATE LACROSSE DAILY INJURY REPORT

TYPE: 1. Athletic
 2. Non-athletic
 3. Health

DATE: _____

NAME	NATURE OF INJURY	TYPE	DISPOSITION	DATE OF EXPECTED RETURN
1. _____				
2. _____				
3. _____				
4. _____				
5. _____				
6. _____				
7. _____				
8. _____				
9. _____				

ON INJURY LIST

NO PRACTICE — SWEATS	PRACTICE UNIFORM NO CONTACT "GO-AS-GO"	REMOVED FROM INJURY LIST "FULL GO"	COMMENTS

Chapter 8

SOCCER

Robert Guelker
Southern Illinois University

Soccer requires skills involving the feet, thighs, chest, and head. The goalkeeper is the only person on the field who can legally use his hands on the ball, providing it is done inside the penalty area. Outside the penalty area, the goalkeeper is like any other player, as far as the use of hands.

Because soccer is a bodily contact sport played with little or no equipment, and because it puts great demands on stamina, numerous injuries occur. The hazards most likely to cause injury are related to equipment, playing field, physical conditioning, and skills.

Equipment

The proper game equipment consists of uniform jersey, shorts, and stockings, in addition to shin guards and shoes. Other equipment can include protective or supportive devices for injured areas. The goalkeeper can wear other equipment, and he should do so, especially in practice. (4)

Uniform. The rules on uniform specify that each team wear distinctive colored jerseys. When it is difficult to distinguish teammates from opponents in making split decisions, players could possibly collide with one another and cause minor injury.

All teams should have two sets of uniforms to provide contrast, especially with jerseys and stockings. If economy is a factor, one pair of shorts could be used while the jerseys and stockings could be interchanged to avoid sameness of color of opponents' uniforms. Many players react quickly by noticing the stockings of a teammate without looking up at the player's face or color of his shirt. Distinctive colors in uniforms also prevent much confusion on the field of play.

For safety of the opposition, the referees should check the players' shoes prior to each game to determine if the shoes comply with rule specifications. In order to have better footing on wet or muddy fields, some players will attempt to wear American football cleats, which are forbidden and are dangerous to opposing players.

Shin Guards. Because of the intricate and agile movements and the speed involved in soccer, many players today elect not to wear shin guards. They believe this piece of safety equipment for the lower leg is burdensome and affects their play. There is no doubt a player has more mobility and quickness of start without the additional weight on his legs. However, the advantages of protection outweigh the disadvantages of wearing the shin guard. There are a number of small, lightweight shin guards on the market that a player can wear without sacrificing very much speed and mobility. Shin guards are recommended for players of both teams particularly when beginners are involved. Injury could occur as a result of the beginner's lack of skill, experience, and control of bodily movements.

Poor timing often results in the kicking of an opponent instead of the ball. Also, it is advisable to wear shin guards when playing against an opponent who is reputed to play in a rough or overly aggressive style.

Supporting Devices. Safety can be provided by wearing protective supporting devices over injured or weak bodily areas. Support can be given with expert taping or by wearing a suitable brace. A brace that allows lateral as well as frontal and backward movement is recommended for protection and support of weak knee joints. Some knee braces with metal hinges provide a good safeguard, but do not allow lateral movement of the knee. A coach should act under the advice of an expert trainer or physician before permitting an injured player to return to action, even with a supporting device.

Goalkeeper's Equipment. Because the goalkeeper's method of training should involve different methods of practice, he can wear equipment to safeguard himself from injury, especially abrasions and contusions of the legs and arms. Since goalkeeper training involves the art of diving and falling to the ground from various positions and angles, the equipment should include pads to protect elbows, knees, and hips. Shorts with built-in padding are available. Baseball sliding pads can also provide protection for the hips and upper legs.

Because the goalkeeper can receive many abrasions and cuts during a training session, he should be encouraged to wear an old sweat suit during practices. While this minimizes abrasions, it also provides some added protection for the goalkeeper in addition to his protective padding.

In teaching a beginning goalkeeper how to dive, it may be necessary to provide him the safety of practicing in a jumping pit, on mats, or at least on soft ground with good turf.

Playing Field

Safety can be provided by conducting all practice sessions and match games on nonhazardous fields. There should be no hooks or protrusions on the front of the goalposts or the crossbar. The method of attaching the crossbar to the uprights should be checked prior to each game to determine whether there are any loose bolts or connections.

The playing ground should be free from all obstacles and hazardous conditions. Holes and gulleys should be smoothed and filled to minimize possibilities of injury. Frozen footprints which result from playing on a muddy field should be eliminated, if possible, before the next game.

Many games are played on football fields. Holes left from field markers can cause a severe ankle injury to the player who steps in these small holes with a cleat. Safety could be provided by capping the holes and/or covering them with a piece of sod or fresh dirt.

Teams have conducted practice sessions and played matches on icy fields. For the safety of the players, the coach should postpone play and/or practice under these conditions. Poor footing causes a lack of body control movements, and therefore enhances contact and possible injury.

Physical Conditioning

Injury prevention can be attained through physical conditioning which permits optimal development of strength, endurance, and flexibility of those body areas most vulnerable to injury.

The type of injuries, and the body areas where these injuries are most likely to occur, are as follows:

1. Abrasions — all parts of the body, particularly the legs
2. Contusions — all parts of the body, particularly the quadriceps

3. Sprains — ankle and knee joints

4. Strains — lower extremities, especially the gastrocnemius muscle, the Achilles tendon, and the patellar tendon

5. Fractures — toes, metatarsal bones, and the fibula and tibia. (1)

There is no magic formula to prevent these injuries from occurring. Once the environmental safety factors have been provided, the most important safety item for a player's well-being is proper physical conditioning.

Since soccer is a game of stamina, a player must be in top physical condition in order to set the pace of the game, otherwise, the opponent may set the pace. Once a player has fatigued and is unable to meet the physical demands made of him, he is susceptible to injury caused by poor timing and decreases in muscle strength. Conditioning a player for optimum performance involves constant training.

Regarding post-season conditioning, a player should watch his diet to avoid excessive increase in weight. Also, he should have at least a minimal amount of exercise to maintain muscle tone. As a consequence, preseason conditioning will be easier, and there will be less danger of injury. Walking, jogging, participation in basketball, volleyball, handball, and tennis matches provide beneficial exercise. Because of the fresh air and walking involved, golf is a good summer and off-season activity. Also, swimming and cycling are excellent off-season activities.

In preseason conditioning, one should concentrate not only on skills, but also on preparation of a player to withstand any work load that might be imposed upon him by the coach when the regular season's training begins. Besides developing his cardiorespiratory functions, the player should develop all muscle groups of his body. Emphasis should be directed at developing weak areas, especially the ankle and knee joints. Preseason training can include calisthenics involving numerous flexibility exercises; running forward and backward without the ball; running with the ball and performing skills individually; working on skills in small groups with the ball; play in abbreviated games of three to five players on each side; and wind sprints. Distance running of one to three miles a day at least 3-4 times a week will help develop cardiovascular endurance. Weight training for the quadriceps and hamstring muscles will develop leg strength and power to enhance skill and help to prevent injury to these muscles. Sprinting of short duration will help to develop muscular endurance and training off the mark.

Bud Buddell, trainer for the Southern Illinois University at Edwardsville, and former USA Olympic trainer, tests the ankles, quadricep muscles, and the hamstring muscles of all soccer players on the first day of practice. All players who cannot pull 90 pounds with the quadricep muscles 10 times and 40 pounds with the hamstring muscles on the universal weight machine are put on a weight training program to strengthen these muscles in order to minimize probabilities of injury.

In-season conditioning involves the work load and type of activity needed to meet the demands of playing the game. Generally, a player's work load in practice should exceed the requirements of the game. Thus, all players should be sufficiently fit to play extra time without a decrease in performance.

Because the game demands much stopping, starting, turning, and jumping with and without the ball, it is vital for a player to train regularly simulating movements used in match situations. Drills with and without the ball can be utilized in providing these necessary movements. Most game situations drills will accomplish this purpose. (3)

An example of a dribbling drill which meets this objective is for a forward to play one on one with a defender in which he practices all the moves including screening the ball, he would utilize in a game. The drill may proceed for one minute, and then the players switch functions. This drill might be repeated two or three times. As a variation of this drill, the one on one situation might involve a goalkeeper, and the forward who attempts to make a shot on goal.

Warm-up

It should be noted that the warm-up has real preventive value in conditioning and before playing a game. Its purpose is to sufficiently loosen and stretch the various muscles and ligaments and other collagenous tissues. This reduces muscle tears and ligament sprains. The warm-up should include easy running, stretching, and general body conditioning exercises. Pregame warm-ups should include ball control drills with moderate movement. The warm-up should be climaxed by a few wind sprints.

Skill

The objective of all soccer players is to develop skill in playing the game in order to improve performance. Skill definitely is a primary goal when a person is conditioning for preseason and in-season play. Regarding in-season work, the coach is responsible for the type of activity used in the development of skills. In addition, each player should use those moments available to him before and after practice to work on improving his skills. The player with the best body control, who knows how to protect himself in intricate play situations, will be the most successful at avoiding injury.

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